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DEVELOPMENT OF ANALYTIC TECHNIQUES TO MEASURE HUMAN EXPOSURE TO FUEL ADDITIVES

SOUTHWEST RESEARCH INSTITUTE

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Donald E. Johnson, John B. Tillery,
John M. Hosenfeld, James W. Register

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8500 Culebra Road
P. O. Drawer 28510
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Purpose of this study was to investigate analytical and sampling methodology for measuring amount of exposure and health effects of fuel additives to urban and rural populations. Both human exposure to normal levels of fuel additives present in urban traffic and to the high concentration under occupational conditions such as attendants in garages and parking lots and to policemen working in heavily trafficked areas. Fuel additives studied included the heavy metals, lead, manganese, copper, and zinc. Also measured in human tissue samples was the fuel impurity, cadmium. Trace metals in hair were determined to reflect long-term exposure. Blood and urine samples reflected short-term exposure. Feces measurement for lead and cadmium provided an estimation of dietary contributions.

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by

D.E. Johnson, J.B.Tillery,
J.M. Hosenfeld, and J.W. Register

Southwest Research Institute
San Antonio, Texas

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EPA Project Officer: Douglas L. Worf

Human Studies Laboratory
National Environmental Research Center
Research Triangle Park, North Carolina 27711

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I. OBJECTIVE

The principal objective of this investigation has been to develop analytical and sampling methods to accurately measure human exposure to fuel additives. An additional objective was to obtain some preliminary information about the quantities of certain fuel additive residues in body burdens of individuals exposed to relatively high concentrations of internal engine exhaust emissions. Once the analytical and sampling methods were perfected, then they could be utilized by the Environmental Protection Agency to monitor human exposure to some of the more important and commonly used fuel additives on a continuing basis. This will permit the quantitation of the exposure to humans and provide the basis for prediction of the expected effects of long term, low level exposures.

II. INTRODUCTION

The Environmental Protection Agency has been charged with the responsibility of measuring the exposure of humans to various air pollutants and determining whether the amounts of these pollutants are a potential hazard. They have the responsibility for setting acceptable pollution levels and for enforcing the regulations to maintain levels below the standards. This responsibility includes the residues resulting from fuel additive components.

Fuel additives containing heavy metals are one of the more important types of fuel additives currently in use in the United States. It has been shown that trace metals may accumulate in various tissues and possibly contribute to the incidence of carcinogenic, mutagenic and teratogenic processes. Lead, manganese, copper, zinc, boron, calcium, and silicon are all important trace element constituents in fuel additives. There are other trace elements present as impurities, such as cadmium, chromium, vanadium, nickel, and lithium. Many health officials consider the optimum procedure for determing exposure to air pollutants to be via measurement of body burden levels. This approach has been particularly useful for monitoring heavy metals. The amounts of metal-containing fuel additives used in the U.S. is large. The types of additives used may vary, especially with the discontinuation of leaded gasolines.

This project was designed to measure body burdens of five heavy metals, namely cadmium, copper, lead, manganese and zinc. Four substances (blood, urine, hair and feces) were selected to provide data on the total body burden of these metals. Measurement of the metals in blood and urine provides an indicator of total body burdens and will also reflect short term exposure. Hair has been used as an indicator of body burdens of the five metals and, in general, reflects a longer term of exposure than do blood and urine. Feces measurements for lead and cadmium were included to provide an estimation of the dietary contribution to the total body burden of these two metals. It is known that 10% or less of orally ingested lead and cadmium is absorbed, whereas 30% to 50% is absorbed via inhalation. The project included three groups of individuals exposed to relatively high concentrations of internal engine exhaust emissions with each of the groups having its own matched control group. Each of these six groups of individuals were to be sampled at four separate times. Collection of blood, urine and feces samples was made at specific times during the testing period, and hair samples were collected over a four-month period at random times. The general plan was to compare the body burdens of these metals in the individuals before and after a weekend and before and after a vacation. This experiment was designed to test the premise that short term changes in the levels of the various pollutants in the environment would be reflected in changes in the body burden levels of the metals. The design was also capable of comparing body burdens of these compounds between each heavily exposed group and its matched control group. For three of the metals - namely zinc, manganese and copper - an important aspect was to determine whether or not body burdens could be related to environmental exposure (primarily air). These three metals are present as normal biochemical substances.

The exposed groups selected were (1) policemen working on foot in downtown Houston, Texas, (2) individuals working in covered garages and (3) individuals living within two blocks of a major expressway in metropolitan Houston. Each of these groups had a control group matched for variables such as age, sex, smoking habits, education and ethnic background. Other studies of this type have indicated that these variables are important with regard to body burden levels of heavy metals. The policemen and garage attendants were all male subjects; thus, the individuals in the corresponding control groups were all male. Those individuals living near a freeway and their controls were female. Individuals between the ages of 18 and 53 were selected for study.

III. EXPERIMENTAL

A. Design of Project

The program was designed to monitor six groups of individuals. For convenience, these groups are labeled as follows:

Group 1 - Policemen
Group 1A - Control group for policemen
Group 2 - Garage attendants
Group 2A - Control group for garage attendants
Group 3 - Females living near freeway
Group 3A - Control group for females living near freeway

There were to be 36 people in each of the above groups, or a total of 216 for the complete test. Each individual was to be sampled four separate times for blood, urine, hair, and feces. Measurements for lead, cadmium, manganese, zinc and copper were to be made on all samples of blood, urine and hair. On the feces samples, lead and cadmium were to be measured. Hematocrits were to be run on all blood samples; for all of the urine samples, specific gravities, total urine volume, creatinine and coproporphyrin were to be measured.

The project was designed so that the first set of matched samples were to be taken before and after a weekend. The second set of matched samples (the third and fourth samples) were to be taken before and after a vacation period.

B. Selection of Experimental Subjects

Initial contacts with potential human volunteer subjects were made using several approaches. For the policemen and their controls, the initial contacts were coordinated with the director of personnel in charge of employees working for the City of Houston. During these contacts, information was supplied regarding the objectives of the program and by whom the program was supported, and detailed information sheets concerning the overall program were given to the personnel director. Permission was obtained to talk to potential volunteers for the survey. Through this personnel office, appointments were arranged with supervisory personnel for the police department and for office employees in City Hall. The latter group was the source of control subjects for the policemen.

The subjects for the women living near freeways and their controls plus the controls for garage attendants were obtained through the personnel offices of a large hospital in the Houston area and a medical school. Permission to contact the subjects was obtained through the personnel offices of these two organizations, and arrangements were made to meet with potential volunteers as a group. Announcements were posted on bulletin boards giving brief information about the survey and the time and place of a meeting.

The garage attendants were contacted by visiting a number of the covered parking garages, talking with the managers, and leaving information sheets and instructions that there would be someone to visit the garage within a day or so to talk to interested volunteers. Because of the limited number of potential volunteers working in any one parking garage, between 10 and 12 covered parking garages were contacted in the initial stages. In each of these initial contacts, the emphasis was to obtain permission from the highest level necessary,followed by contacts with the immediate supervisors and then the announcement of a meeting to follow generally from 1 to 2 days to obtain information about the survey. Initially, there was interest in obtaining the controls for the garage attendants from large buildings in the downtown Houston area served by a building custodian services group. A number of contacts were made with these organizations, since for one of these buildings, several hundred building custodians were employed daily. These contacts resulted in none of the groups providing permission to talk with the building custodians.

The initial contact with the potential human volunteer subjects was in the form of a meeting to explain the general format of the survey, to answer questions, and to pass out questionnaire forms to be filled out by those interested in volunteering. A sample of the questionnaire form used in the survey is presented in Appendix A. The questionnaire was designed so that all information necessary for making a proper selection was included. Some seventeen questions regarding the occupation, place of residence, health, and personal statistics of the potential subject were included.

At the meetings, information sheets were distributed to those interested, and any questions regarding the study were answered. Those subjects who volunteered were told that questionnaires would be examined and they would be notified via letter whether or not they had been chosen for the survey. They were told at this initial meeting that they would be paid $35 for the complete study - that is, to provide four samples each of hair, blood, urine and feces. They were also told that there would not be a partial payment of money for partial completion and that they had to complete the full study in order to receive payment of $35. Copies of the information sheets provided to the interested volunteers are shown in Appendix B.

The response to the survey was excellent for the policemen and their controls and for the females living near freeways and their controls; however, the response of the parking garage attendants and of the building custodians and attendants and orderlies in hospitals who served as controls for the parking garage attendants was not nearly as good. To obtain a sufficient sample for the parking garage attendants, a considerable amount of effort was expended in contacts with covered garages in downtown Houston to solicit volunteer participants.

The design goal was forty-five subjects from each group to allow for selection between the various volunteers to match the exposed and control groups with respect to age, sex, smoking habits, education, and ethnic background. The exposed groups (groups 1, 2, and 3) were selected first, and then the controls (1A, 2A and 3A) were matched as closely as possible to the exposed groups with regard to the variables specified above. For the parking garage attendants and their controls, there was no surplus of volunteers, so the selection was minimal.

In the contacts with supervisors, managers, and other individuals in charge of various groups contacted, it was emphasized that the participation of their employees in the survey would not interfere with their duties during working hours. The sampling was to be taken either at the beginning of their work day or at the end, and arrangements would be made to meet the individuals and obtain samples in as rapid and efficient manner as possible. Only with these assurances was it possible to obtain permission to utilize these human subjects. The emphasis throughout the survey was to bring the people who would take samples of blood and collect urine and feces samples to the point where the individuals were working. The alternate procedure, and one which would have taken considerably less time and effort for the survey team, was to provide a central location with the facilities for drawing blood, etc. and have the human subjects travel to this spot. This was not followed because of the probable poor response from potential volunteers and the fact that the intent of the project was to sample at a specific time during the week and during the day. The large number of subjects to be sampled during the project and the fact that four different matched samples of blood, urine, hair and feces had to be taken required a much greater degree of control than the central location would permit.

The first sampling period was to coincide with a Friday and a Monday to represent before and after a weekend. Letters were sent out to the subjects selected for the study, indicating the time and place for a meeting which was to be held on a Thursday, and the survey would begin on the next day and a second sampling date on the following Monday. A Houston telephone number was given for those subjects not able to attend the meetings. An alternate weekend was offered to these subjects. When these meetings were held, the subjects were again informed of the intent of the project and the details of the sampling schedule, and other information was provided as needed.

Once the subjects were fully informed about the program, those that wanted to participate were requested to fill out and sign an informed consent form. They were told that this was a requirement of the Department of Health, Education and Welfare and were informed of the purposes of this form. Each subject was given instruction sheets specifying sample collection procedures, and each was given two containers for collection of urine, two containers for fecal material and four plastic bags for hair samples with four pre-addressed and postage paid envelopes to be mailed to the SwRI laboratories.

A higher percentage of subjects dropped out of the program (45 selected, 36 needed) than was expected. Some of the reasons given were: too little money for the amount of trouble involved; too much hair required for each sample; and fear of the collection of blood samples. It is probable that the amount of money paid was marginal for the amount of participation needed. Participation of many of the subjects was based on the desire to assist in understanding the air pollution problems in their area. For these subjects, the money paid was not the primary inducement, but it was welcomed. For the garage attendants and their controls, the money paid appeared to be one of the primary factors in their participation in the survey.

The data contained in the questionnaire forms for the volunteer participants were keypunched according to the format described in Appendix A. The keypunched cards were sorted and listed for use in selection matching between the exposure groups and respective control groups of volunteer participants. For the analysis, ordered listings were obtained regarding age, education, ethnic background, hair color, and smoking habits of the volunteers.

An ordered listing of the Card 2 data (Card 2 contains the pertinent parameters data obtained from the questionnaire forms) is presented in Appendix C. This listing is ordered according to participant ID number and contains data for all volunteers who were selected to participate and who successfully fulfilled the sample collections. Table I presents in summary form the data for the participants who volunteered for the project. Table II shows these same data in schematic form. The principal differences between the control and exposed groups are in the policemen and their controls. The controls are much better educated than the policemen. The controls were selected from the male office staff in the City Hall of Houston, Texas, and many were engineers, architects and other college graduates. The garage attendants are slightly younger than their controls.

The Card 1 data containing names and addresses of the volunteer participants are on file at Southwest Research Institute and will be maintained, in confidence, for future reference if a justified requirement arises in the future. The Card 1 data provide a direct correspondence between the arbitrarily assigned ID numbers and the names and addresses of specific volunteers.

As stated earlier, one of the objectives of this project was to compare a group of people exposed to relatively high concentrations of engine exhaust to a matched control group of people exposed to lesser quantities of engine exhausts. From the data shown in Tables I and II, it would appear that the groups were matched quite well for the variables of interest. The control subjects all worked in the central part of Houston, Texas. Each worked inside an air conditioned building. The majority of these subjects lived within the Houston City limits (control females lived more than 2 blocks from a freeway); thus, each was exposed to higher concentrations of air pollutants than individuals that lived and worked in a rural area. It is important to understand that these control groups should have been exposed to lower concentrations of engine exhaust fumes than the group of subjects they were matched with, but they do not represent low exposure groups.

C. Collection of Samples

As mentioned above, the first set of samples was taken on a Friday and the following Monday. The second set of samples was taken before the Christmas vacation (December 20, 1972) and after Christmas vacation (January 2, 1973). A short meeting was held the day before each sampling period to instruct the participants on how to collect the samples and to pass out urine and feces containers for that sampling period.

The urine samples were overnight specimens. The subjects were instructed to begin collecting urine in the container provided any time after supper (generally between 6 and 10 PM) and to continue collecting the total urine output until they reported to the sample collection survey team, or 8 AM the next morning. Urine was collected in wide-mouth polyethylene containers, one-half gallon size. The polyethylene containers were washed thoroughly with deionized water prior to their use on the project. Subjects were cautioned against putting anything into these urine containers other than their urine. The polyethylene containers for fecal samples were also washed with deionized water, and the subjects were instructed to collect the fecal sample anytime during the interval that the urine was collected that was convenient for them. The subjects were instructed to bring the urine and fecal samples with them at the time and place assigned for collection of their blood sample. At that time, 20 ml of whole blood was taken from each individual using a B&D vacutainer, low lead content (0.5 micrograms or less) containing sodium heparin as an anticoagulant. The collection of blood samples was conducted by laboratory technicians under the supervision of a physician. The blood samples were placed in styrofoam boxes containing wet ice. The fecal samples were placed in styrofoam containers with dry ice.

The policemen and their controls were sampled as they came on duty (between 6 and 8 AM and 3 and 4 PM). The females living near freeways and their controls plus the controls for the garage attendants were sampled at the end of their work day (5 to 7 PM). The garage attendants were sampled at different times during the day to accommodate the different work shifts of the garage attendants. Generally, this covered a time period from 8 AM to 5 PM. Most of the garage attendants worked shifts ranging from 4 to 8 hours in length.

Four subjects from group 3 and four subjects from group 3A were selected at random, and each was asked to collect samples of dust from their vacuum cleaners and samples of tap water from their homes.

Once all samples had been collected for a particular day, they were transported to the SwRI laboratories located in Houston. The blood samples were processed for hematocrit determinations and to collect blood plasma. A small amount of whole blood was needed for certain analyses, and the remainder was used for preparation of plasma via centrifugation. Once this had been conducted, the whole blood and blood plasma samples were frozen. For the urine samples, the volume was determined, specific gravity measurements made, and then approximately a 250-milliliter aliquot was put into a polyethylene container and made to approximately 1% acetic acid and then frozen. The frozen samples of urine, blood and feces were then transported to the San Antonio laboratories and kept frozen until analyses were made.

The subjects were instructed to collect four separate hair samples (at least 2 to 3 grams per sample) at their usual haircut or at intervals of approximately one month during the testing period. It was suggested that they could collect hair from their combs or brushes on a daily basis to accumulate the required quantities of hair. The subjects were cautioned against including hair from someone else. The subjects were instructed to put the hair clippings into the plastic bags provided and then mail them to the SwRI laboratories. They were told that when they had completed the sampling for four urines, four bloods, and four feces and in addition had mailed in four samples of hair, their checks for $35 would be mailed to them.

The principal problem in the collection of samples was one of subjects forgetting to show up at the proper time and place or forgetting to bring the proper samples. Every effort was made to accommodate the subjects, including making visits to their homes to pick up their samples. Collection of the samples from garage attendants located at some six different locations was probably the most difficult part of the collection. Because of the poor response to our survey request, there were small numbers of individuals located at each of these garages. The survey team had to make numerous stops to complete the sample collection for this group. Although the decision to send the survey team to the individuals participating in the survey resulted in considerable effort, it probably is the optimum procedure to obtain samples at the correct time and place from this number of individuals.

D. Methods of Analysis of Samples

1. Metal Analyses

a. HAIR

Cadmium, Copper, Lead, Manganese and Zinc

Preparation of human scalp hair for analysis by atomic absorption spectrophotometry* was based on the method of Hammer et al(1) and Harrison et al(2). The washing procedure was modified in that the E.D.T.A. wash was eliminated. All five metals were determined by aspiration of the digested hair solution into an acetylene-air flame using a single-slot burner head. Wavelength, slit setting, hollow cathode current, and gas flow rates were set as suggested by the manufacturer.(3) A Deuterium Background Corrector was used with all metal determinations, and for the zinc analysis a 1:40 dilution with deionized water was necessary.

b. BLOOD

Cadmium and Lead

Cadmium and lead analyses were carried out on whole blood using the procedure of Ediger and Coleman(4)(5). The "method of additions" was used to establish a blood standard which was then used to quantitate the unknown blood samples. A Deuterium Background Corrector was used with both analyses.

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* A Perkin-Elmer 306 Atomic Absorption instrument was used for the trace metal analyses.

Copper and Manganese

Whole blood, diluted with deionized water 1:15 for copper analysis and 1:1 for manganese analysis, was analyzed using a graphite-furnace by the methods of Matousek and Stevens (6). A Deuterium Background Corrector was used with both metals analyzed. Instrument operating parameters were:

Copper:

Wavelength	324.7 nm	Dry	30 sec at 100°C
Slit	3.0 mm	Ash	40 sec at 800°C
Source	15 mA	Atomize	7 sec at 2500°C
Damping	No. 1	Gas	N_2 at 20 psi/No.3.5
Sample Volume	5 μl		

Manganese:

Wavelength	279.5 nm	Dry	30 sec at 100°C
Slit	1.0 mm	Ash	70 sec at 600°C
Source	16 mA	Atomize	7 sec at 2400°C
Damping	No. 1	Gas	N_2 at 20 psi/No.3.5
Sample Volume	10 μl		

Zinc

Zinc was determined in a 1:40 dilution of plasma with deionized water using the methods of Dawson and Walker (8) and Sprague and Slavin (9). The diluted plasma was aspirated into an air-acetylene flame using the instrumental operating parameters recommended by the manufacturer (3). A Deuterium Background Corrector was utilized.

c. URINE

Cadmium

Cadmium in urine was analyzed by a modification of the Hauser et al(10), Kahn and Sebestyen(11), and Ediger and Coleman(4) procedures. A 100µl aliquot of acidified urine was used in the Delves cup procedure and analyzed using the instrument manufacturer's recommended parameters(3). The Deuterium Background Corrector was also used. Matrix effects were corrected for by using the "method of additions" to establish a urine standard.

Copper, Lead, and Manganese

The graphite furnace was utilized in the analysis of these three metals. The procedures used were patterned after those of Amos et al(7) and Davidson and Secrest(12). It was necessary to dilute the urine 1:1 with dilute HCl (0.1N) before analyzing for manganese. The Deuterium Background Corrector was used on all three metal determinations, as was the "method of addition", to establish a urine standard. The following instrumental parameters were used:

Copper

Wavelength	324.7 nm	Dry	30 sec at 100°C
Slit	3.0 mm	Ash	25 sec at 1000°C
Source	16 mA	Atomize	7 sec at 2500°C
Damping	No. 1	Gas	N_2 at 20 psi/No.5
Sample Volume.	25µl		(grooved graphite tube)

Lead

Wavelength	283.3 nm	Dry	30 sec at 100°C
Slit	1.0 mm	Ash	30 sec at 450°C
Source	8 mA	Atomize ...	7 sec at 2100°C
Damping	No. 1	Gas	N_2 at 20 psi/No.4
Sample Volume .	10µl		(grooved graphite tube)

Manganese

Wavelength	279.5 nm	Dry	30 sec at 100°C
Slit	1.0 mm	Ash	50 sec at 600°C
Source	16 mA	Atomize	5 sec at 2200°C
Damping	No. 1	Gas	N_2 at 20 psi/No.4 (grooved graphite tube)
Sample Volume	25µl		

Zinc

Zinc in urine was determined by the method of Dawson and Walker (8) using the aspiration into an air-acetylene flame of a 1:1 dilution of the urine with deionized water. Instrument parameters are those recommended for zinc analysis by the manufacturer (3). The Deuterium Background Corrector was utilized, and the "method of additions" used to establish a urine standard.

d. FECES

Cadmium and Lead

A wet-digestion procedure similar to that of Adrian (13) was used to digest the feces. Heavy-walled, 100-ml centrifuge bottles were used to digest 5-gram samples of the feces. A perchloric acid:nitric acid solution 1:1 was used for the digestion. The acid digest was filtered through a Reeves Angel, glass fiber filter and rinsed three times with 1% HNO_3. The filtrate and rinses were collected in a 25-ml volumetric flask and made to volume with deionized water prior to analysis.

Cadmium and lead were determined on the digested feces utilizing the graphite furnace. The Deuterium Background Corrector was used in both cadmium and lead analysis. The "method of addition" was used for both metal determinations to establish a feces standard to calculate the concentration of the unknown samples. Instrument settings were:

Cadmium

Wavelength	228.8 nm	Dry	30 sec 100°C
Slit	1.0 mm	Ash	30 sec 300°C
Source	10 mA	Atomize	7 sec 1500° C
Damping	No. 1	Gas	N_2 at 20 psi/No.4
Sample Volume	15µl	(grooved graphite tube)	

Lead

Wavelength	283.3 nm	Dry	30 sec at 100°C
Slit	1.0 mm	Ash	30 sec at 450°C
Source	8 mA	Atomize	7 sec at 2100°C
Damping	No. 1	Gas	N_2 at 20 psi/No.4
Sample Volume	10µl	(grooved graphite tube)	

e. PRECISION ACCURACY & RECOVERY STUDIES

Methods used to collect data on the precision and recovery studies were performed under the same conditions (i.e. sample preparation, dilutions, instrument operating parameters, etc.) that were used to prepare and analyze the samples.

(1) Detection Limit

Detection limit is defined as that concentration of metal which, under the given operating conditions, will produce a response (signal) that is twice the average background noise (i.e. a signal-to-noise ratio of 2:1). This value is calculated from the peak produced by a low concentration spike sample.

(2) Sensitivity

Sensitivity is defined as that concentration of analyte which will give 1% absorption (Abs.). This value is also calculated from the peak produced by a low concentration spike sample.

(3) Quality Controls

To overcome the matrix effect of the samples, a "sample standard" was made by spiking a given sample (e.g. blood, urine, etc.) with several different concentrations of analyte. The "method of additions" was used to determine the natural concentration of the metal of interest in that "samp[illegible]ndard". This "sample standard" was then run after every 5 to 10 samples as a quality control and as a means to obtain a factor to calculate the metal concentrations in the unknown samples.

Periodically, this sample standard was made up fresh and recalibrated with a frequency depending upon the rate of degradation of the sample matrix. The concentration factor applied to the unknown samples was calculated using the average values of the quality controls which bracket those samples. This way, a continuous check was maintained upon the analytical parameters.

(4) Blood

Two approaches were used in determining the precision of the analytical methods for blood (and plasma). First, five to ten individual blood samples (same blood) were spiked at a low and a high concentration of the analyte. These samples were each analyzed 3 to 8 times for each metal. Second, data from the quality controls actually analyzed with the samples were collected and used to calculate the precision.

Since both methods gave similar results, the data from the quality control samples have been reported.

(a) Cadmium

Analysis of six (6) unspiked bloods (quality control samples) for cadmium by the Delves Cup technique gave a mean concentration of 1.1 μg/100 ml blood, a standard deviation of ± 0.3 μg/100ml blood, and a relative standard deviation (RSD) of 25.7%. Analysis of seven (7) spiked blood quality control samples (1.0μg/100 ml) gave a mean concentration of 1.3 μg/100 ml, a standard deviation of ± 0.3 μg/100 ml, and a RSD of 19.5%.

Using these operating parameters, the detection limit is 0.38 μg/100 ml, and the sensitivity is 0.02 μg/100 ml for 1% Abs.

(b) Copper

Ten (10) unspiked blood samples were analyzed by the graphite furnace for copper. The mean concentration was 60 μg/100 ml, a standard deviation of ± 3.5 μg/100 ml, and a RSD of 5.8% Ten blood samples spiked (Cu) at 75 μg/100 ml gave a standard deviation of ± 5.4 μg/100 ml and a RSD of 4.0%. The calculated detection limit for this method is 3.5 μg/100 ml, and the sensitivity is 0.96 μg/100 ml for 1% Abs.

(c) Manganese

Unspiked blood samples (5) diluted with water, (1:1), were analyzed for manganese by the graphite furnace technique. Mean concentration was 0.7 μg/100 ml, standard deviation was ± 0.14 μg/100 ml, and RSD was 20.0%. Ten spiked blood samples (1.5 μg/100 ml) were also analyzed for manganese. The standard deviation was ± 0.12 μg/100 ml, and the RSD was 5.5%. Detection limit is 0.16 μg/100 ml, and the sensitivity is 0.05 μg/100 ml for 1% Abs.

(d) Lead

Lead analysis by the Delves Cup method on nine (9) unspiked bloods (quality controls) gave a mean concentration of 17 μg/100 ml, a standard deviation of ± 3.7 μg/100 ml, and a RSD of 22.1%. Nine (9) spiked bloods (25 μg/100 ml) analyzed for lead gave a standard deviation of ± 9.2 μg/100 ml and a RSD of 22.0%. Detection limit of the Delves Cup technique is 4.8 μg/100 ml, and the sensitivity is 0.65 μg/100 ml for 1% Abs.

(e) Zinc

Zinc was analyzed on ten (10) unspiked plasma samples (quality controls) by aspirating the diluted (1:1) plasma into an air-acetylene flame. The mean concentration was 93 μg/100 ml, the standard deviation was ± 2.3 μg/100 ml, and the RSD was 2.5%. Eight (8) spiked plasmas (100 μg/100 ml) were analyzed for Zn by the same method. The standard deviation was ± 9.6 μg/100 ml, and the RSD was 5.0%. The detection limit is 9.8 μg/100 ml, and the sensitivity is 1.8 μg/100 ml for 1% Abs.

(5) Urine

Only the data from the quality control samples run with the analysis of the urine samples were used to calculate the precision of the urine analysis.

(a) Cadmium

Ten (10) unspiked urine quality controls analyzed by the Delves Cup technique were used for cadmium determinations. The mean concentration was 1.0 μg/liter, a standard deviation was ± 0.4 μg/l, and the RSD was 40.6%. Twelve spiked urines (1μg/l) gave a standard deviation of ± 0.5 μg/l and a RSD of 26.1%. Calculated detection limit for this method was 0.63 μg/l with a sensitivity of 0.02 μg/l for 1% Abs.

(b) Copper

Unspiked urine quality controls (6) analyzed for copper by the graphite furnace technique gave a mean concentration of 13.2 μg/l, a standard deviation of ± 1.1 μg/l, and a RSD of 8.4%. Quality control urine (5) spiked at 10 μg/l gave a standard deviation of ± 3.5 μg/l and a RSD of 15.0%. The detection limit is 1.1 μg/l, and the sensitivity is 0.2 μg/l for 1% Abs.

(c) Manganese

Manganese determined by the graphite furnace in the unspiked urine quality controls (4) gave a mean concentration of 1.8 μg/l, a standard deviation of ± 0.6 μg/l and a RSD of 35.6%. Ten spiked quality controls (5μg/l) gave a standard deviation of ± 1.2 μg/l and a

RSD of 18.4%. Detection limit is 0.51 μg/l, and the sensitivity is 0.14 μg/l for 1% Abs.

(d) Lead

Unspiked urine quality controls (8) analyzed for lead by the graphite furnace gave a mean of 26 μg/l, a standard deviation of ± 4.0 μg/l, and a RSD of 15.7%. Four spiked urine (100 μg/l) quality controls gave a standard deviation of ± 3.7 μg/l and a RSD of 3.7%. The detection limit is 4.6 μg/l with a sensitivity of 1.3 μg/l for 1% Abs.

(e) Zinc

Nine (9) unspiked urine quality controls were used for the determination of zinc by flame technique. The mean concentration was 13.2 μg/l, standard deviation was ± 0.6 μg/l and the RSD was 4.5%. Nine (9) spiked quality controls (50 μg/l) gave a standard deviation of ± 3.2 μg/l and a RSD of 5.1%. Calculated detection limit of this method is 2.3 μg/l, and sensitivity is 0.31 μg/l for 1% Abs.

(6) Hair

All hair analyses were done by the flame technique.

A large quantity of hair (approximately 30g) from one individual was used in the precision and recovery study. A total of 45 spiked and unspiked hair samples and standards were analyzed using the conditions previously stated for each analyte metal. Spikes were added to the individual hair samples immediately after the digestion acids had been added.

Recovery of analyte is based on 10 ml standard solutions that have been spiked with the analyte metals at the same concentrations as the spiked hair samples final volume (10 ml) should be if all the metal were recovered.

Summary of the results is given below.

Sample	n	mean µg/g	Std. Dev. µg/g	RSD %	% Recovery	Detection Limit µg/g	Sensitivity µg/g for 1% Abs.
Cadmium							
unspiked	5	1.98	± 0.12	5.8	---	0.31	0.05
spiked (1.25 µg)	5	3.16	± 0.13	4.0	80.0		
Copper							
unspiked	5	17.0	± 0.45	2.6	---	4.4	2.4
spiked (5µg)	3	21.5	± 0.25	1.1	88.3		
Manganese							
unspiked	5	0.3	± 0.1	26.7	---	0.42	0.03
spiked (5µg)	5	5.2	± 0.3	4.9	94.0		
Lead							
unspiked	5	14.6	± 0.52	3.6	---	0.40	0.03
spiked (5µg)	5	19.2	± 0.70	3.6	97.5		
Zinc							
unspiked	5	154.	± 6.5	4.2	---	3.2	2.2
spiked (10µg)	5	164.	± 5.7	3.5	100		

(7) Feces

A homogenized feces sample combined from several samples was used in this study. Approximately 5 grams of the homogenized feces were used per sample. A total of 47 spiked (0.25 to 10 µg/g) and unspiked samples were analyzed by the method given previously for feces analysis. Spikes were added immediately after the digestion acids had been added to the feces. Recovery of the analyte is based upon the comparison of the spiked feces with standards spiked at the appropriate levels (i.e. spiked at the levels that would be found in the final volume of the spiked feces samples if there were 100% recovery).

(a) Lead

The unspiked feces samples (5) analyzed by the graphite furnace technique for lead content gave a mean concentration of 1.35 μg/g, a standard deviation of ± 0.01 μg/g, and a RSD of 0.7%. Five spiked feces samples (2.5 μg/g) analyzed for lead gave a mean concentration of 2.8 μg/g, a standard deviation of ± 0.6 μg/g, and a RSD of 22.9%. Detection limit for lead by this method is 0.07 μg/g with a sensitivity of 0.04 μg/g for 1% Abs. Lead recoveries in spiked feces samples ranged from 94.8 to 103.1 %.

(b) Cadmium

Cadmium determination in unspiked feces samples (5) gave a mean concentration of 0.55 μg/g, a standard deviation of ± 0.11 μg/g, and a RSD of 20.4%. Five (5) spiked feces samples (0.25 μg/g) gave a mean of 0.8 μg/g, a standard deviation of ± 0.08 μg/g, and a RSD of 10%. The calculated detection limit is 0.02 μg/g, and the sensitivity is 0.01 μg/g for 1% Abs. Recoveries ranged from 75.8 to 82.3%.

(8) Summary

The methods of analysis used to measure the trace metal content of blood, hair, urine, and feces were adequate (i.e. R.S.D.<25%) except for (1) cadmium in blood and urine and (2) manganese in urine and hair.

The analytical methods used for each trace metal determined were consistent with the state-of-the-art of that particular atomic absorption spectrophotometric technique used. Improved procedures are necessary, especially for cadmium in blood and urine.

2. Clinical Analyses

Specific Gravity - Urine

After all samples had been picked up from the subjects, specific gravities were determined, usually at the end of the day, using a urinometer.

Total Volume - Urine

Urinary volume was measured at the same time as specific gravity. Volume measurements were obtained by weighing the urine in the sample bottle, subtracting the bottle weight and applying the specific gravity factor. A 250-ml aliquot with 1% acetic acid was frozen and shipped to the analytical laboratory.

Hematocrits

The capillary tube method was used to run hematocrits on each blood sample. Convenience and blood collection times during the day made it necessary to run the hematocrits at the end of the day.

Creatinine in Urine

Urinary creatinine was determined according to the method described in Manual of Clinical Laboratory Procedures, 2nd edition, 1970, published by the Chemical Rubber Company.

Coproporphyrin in Urine

Urinary coproporphyrin was determined following the procedure of Talman, E.L., "Porphyrins in Urine", in Standard Methods of Clinical Analysis, vol. 2, D. Seligson, ed. (1958).

E. Results

1. Clinical Data

The data from the subjects for hematocrits, coproporphyrin creatinine, urine volume and urine specific gravity are in Appendix D. The average hematocrits and standard deviation for the six groups ase as follows:

	Average	Standard Deviation
Group 1	45.2	3.99
Group 1A	45.6	2.93
Group 2	46.7	3.92
Group 2A	43.4	3.41
Group 3	39.7	3.24
Group 3A	39.7	2.32

These values appear to be normal for each group. There is a statistically significant difference between Groups 2 and 2A which may be due to the slight age difference between these two groups. The median ages of the groups are shown in Table III.

2. Trace Element Data

The complete raw data from the analyses of hair, blood, urine and fecal samples for the trace elements are included in Appendix D. Copper, manganese, lead and cadmium are reported as μg/100 ml of whole blood, while zinc values are μg/100 ml of blood plasma. Hair values are listed as μg/g of washed hair. Urine values are in μg per liter. Cadmium and lead in feces are listed as μg/g.

The data are compiled by groups and by tests. The code for the groups are as follows:

Group 1 - Policemen
Group 1A - Control for Policemen
Group 2 - Garage Attendants
Group 2A - Control for Garage Attendants
Group 3 - Females near Freeways
Group 3A - Control for Females

The four collections of samples are listed as tests 1, 2, 3, and 4. Blood, urine and fecal samples were taken at four specific times from the volunteers, and they are matched samples. Tests 1 and 2 were before and after a weekend. This sampling period was in November of 1972. Tests 3 and 4 represented before and after a vacation. These samples were taken in late December, 1972 and early January, 1973 to cover the Christmas holidays.

Hair samples were collected by the individual volunteers at random time intervals over a four-month period. The first sample collected was Test 1, the second Test 2, etc.

The data were examined statistically by use of a t test using paired comparisons. These calculations produced the test statistic t_c which is based upon Student's t distribution:

$$t = \frac{x-\mu}{s}$$

where x is any random variable, μ is the true mean of the distribution of x, and s is a sample standard deviation. For the test of the difference between means of two groups, t_c is defined as

$$t_c = \frac{(\bar{x}_1 - \bar{x}_2)}{S_{\bar{x}_1 - \bar{x}_2}}$$

where $$S_{\bar{x}_1 - \bar{x}_2} = \sqrt{\left[\frac{(n_1 - 1)\,S_1^2 + (n_2 - 1)\,S_2^2}{n_1 + n_2 - 2}\right]\left[\frac{n_1 + n_2}{n_1 \cdot n_2}\right]}$$

with n_1, the size of sample 1

n_2, the size of sample 2

S_1^2, sample variance of sample 1

S_2^2, sample variance of sample 2

The presumptions are

1) $\mu_{\bar{x}_1 - \bar{x}_2} = 0$

2) The populations from which the two samples were drawn have equal variances.

Then t_c within acceptable limits implies a mean of zero, which implies

$$\mu_1 - \mu_2 = 0$$

or

$$\mu_1 = \mu_2 \quad .$$

Comparisons were made between the groups (positive versus control) for all tests and between the groups for each test. In addition, comparisons were made within groups between Tests 1 and 2 and Tests 3 and 4. These statistical comparisons are considered the minimum necessary to understand the significance of these data. It is understood that the Environmental Protection Agency will conduct a thorough statistical treatment of these data.

a.) Copper

The arithmetic means for copper levels in blood, urine and hair for the six groups of subjects (all four tests combined) are shown in Table IV. Along with the means are the standard deviations and sample sizes. At the bottom of the table are shown the results of the statistical analysis of this data. At a 95% confidence limit ($p = .05$), there are significant differences between groups for blood and urine. For policemen (1) and their control (1A), there is a negative correlation in blood and a positive correlation in urine. For garage attendants (2) and females living near freeways (3), there are positive correlations in blood but no significant differences in urine or hair. From these data, it is not clear whether or not the differences seen are related to exposure to exhaust products.

Although not examined statistically, there are larger quantities of copper in females than males in blood, urine and hair. It has been reported that females have higher levels of copper than males. It has also been shown that oral contraceptives increase copper levels.

Table V shows the averages for each test for copper in blood, urine and hair. These data were also examined using the t test for differences between groups for each test and for differences within groups between Tests 1 and 2 and Tests 3 and 4. The differences between groups for each test were similar to the statistical data between groups for all the tests. There were few significant differences between Tests 1 and 2 and Tests 3 and 4. This is summarized in Table VI for blood and urine samples. Similar comparisons with hair showed no significant differences. There was no indication that copper levels were affected by weekends away from work or short vacations.

b.) Manganese

Table VII shows the results obtained for manganese. There are five significant differences between groups, but four of these are negative (control group higher than exposure group). The large standard deviation seen in group 3A hair is due in large part to relatively high values for one individual. This was the only female Mexican-American in the study.

Table VIII shows the averages for each test. Table IX summarizes the statistically significant differences between Tests 1 and 2 and between Tests 3 and 4 for blood and urine samples. No significant differences were seen in hair samples.

c.) Zinc

The results for zinc are shown in Table X. There are only two significant differences - one positive and the other negative. There are lower levels of zinc in blood and urine of females, while higher levels are found in hair. It has been reported that oral contraceptives lower zinc levels in blood and urine. The average values are considered within normal ranges for females.

Table XI shows the average values for each test. Statistical comparisons within groups produced the results in Table XII.

d.) Cadmium

A summary of the data for cadmium is shown in Table XIII. The levels of cadmium are low in all specimens. These low levels pushed the analytical methods to the limit of their effectiveness. There are five significant differences at the 95% confidence limits, with three of these positive and two negative. The differences between 3 and 3A for blood would have been significant except for the large standard deviations. This is also true for hair levels between 2 and 2A.

Table XIV shows the averages for each test. The statistical comparison of groups test by test shows that the differences between 1 and 1A and 2 and 2A in urine are consistent in all four tests. Table XV summarizes the statistical comparisons within groups. No significant differences were found with the hair samples. It is possible that the levels of cadmium in urine are related to the exposure to exhaust products.

e.) Lead

Table XVI includes the comparison between groups (all tests) for lead. There are significant differences for the male volunteers (policemen-1 versus controls-1A and garage attendants-2 versus controls-2A) in blood and hair. There were slightly higher levels (significant at 0.1 level) in females living near freeways -3 than their controls - 3A in blood. In urine, there are significant differences between groups 1 and 1A and 3 and 3A. In this same table are shown data for urine coproporphyrin. There is a highly significant difference between females living near a freeway and their controls (tc = 4.0351).

Table XVII shows the averages for each test. The statistical comparisons between groups for each test are very similar to the overall comparisons. Table XVIII summarizes the statistical comparisons within groups. There were no statistical differences within groups for hair or fecal samples.

f.) Water and Vacuum Cleaner Dust

Table XIX shows the results of analysis of water samples from homes of individuals in Groups 3 and 3A and water samples from places of work for Groups 1, 1A, 2A, 3 and 3A. The water from City Hall is high in zinc; however, high zinc levels were not found in Group 1A.

Table XX shows the data for house dust of subjects selected at random from Groups 3 and 3A. The data are similar for the two groups. The lead levels are low (4.6-24.3 μg/g) compared with data from other studies of lead in household dust of urban areas (500-900μg/g).

IV. CONCLUSIONS

1. It has been demonstrated that it is possible to survey free living populations for body burdens of trace metals and to relate these body burdens to airborne exposures. In order to make these comparisons, it is essential that the test group of subjects be well matched with a control group for variables such as age, sex, hair color, smoking habits, occupation, ethnic background, place of residence and socio-economic status.

2. Good participation was achieved for four of the six groups of subjects. For policemen and females living near freeways and their controls, there were 180 subjects selected from those that volunteered, and 144 completed the study (80%). Many of these subjects participated because of a real interest in air pollution in their city. The participation from garage attendants and their controls was not nearly as good. Over 300 potential volunteers were contacted, and less than 90 filled out a questionnaire. Only 56 of these completed the study. It appeared that the sum of money offered to these individuals ($35) was borderline for the amount of participation required.

For future studies that include populations of the latter type, it is recommended that the subjects be paid as much as $50 for their services. This assumes that the same extent of participation is required, i.e., four matched samples of blood, urine, feces and hair.

3. Body burdens of copper, manganese and zinc were not significantly elevated as a result of exposure to internal combustion engine exhaust products. This study has provided a considerable quantity of base line data which can be utilized for comparison with data generated in the future. When the quantities of lead fuel additives consumed are substantially decreased, it is likely that the usage of other fuel additives will be increased. Several of the candidate fuel additives contain these three trace metals. Two hundred subjects, both male and female, have been sampled four times for three different specimens for data on these three metals. The test groups of subjects (policemen, garage attendants, and females near freeways) were exposed to predominantly air pollution from internal combustion engine exhaust products with a smaller portion from industrial sources.

4. Levels of lead in blood and hair samples from male subjects appear to be rather high in both test and control groups. In a previous study by Hammer et al (1) on school boys, there were listed five metal exposure rankings according to their expected exposure. Their two highest rankings were in lead smelting areas. The levels of lead of subjects in these two areas were 20.9 and 15.6 μg/100 ml of blood (arithmetic means). The lowest ranking level had 5.4 μg/100 ml of blood. In this study, blood levels were 28.3, 23.1, 21.3 and 18.4 μg/100 ml of blood for the male subjects exposed predominantly to airborne lead from internal combustion engine exhaust products. The average age of the

subjects in this study was between 25 and 30. It has been shown in numerous studies that young children have higher lead levels than do adults.

Hair levels for the school boys in the two highest exposure rankings were 80.2 and 32.3 μg per gram of hair. For the study reported here, the values were 47.6, 29.7, 23.5 and 13.1 μg/g of hair.

5. There are significant differences (95% confidence limits) between policemen and their matched controls for lead in blood, urine and hair. For the garage attendants and their controls, there are significant differences for blood and hair. For females living near freeways, there were higher levels than their control subjects for lead in blood, urine and hair, although only urine was statistically significant at the 95% confidence limit.

There were no significant differences for any of the test groups versus their controls for lead in fecal samples. Measurement of fecal lead provides an indicator for the relative amounts of lead consumed in food or drink. Since there were very little differences for fecal lead between groups, it is concluded that the differences seen in blood, urine and hair reflect exposure to airborne lead. It is likely that the majority of this arises from lead used as a fuel additive.

6. There are differences between males and females for levels of lead in blood and hair. Males had blood lead levels between 28.3 and 18.4, while females were 12.9 and 11.9 μg/100 ml of whole blood. Hair levels for males were 47.6 to 13.1 μg/g of hair, and females hair

values were 7.4 and 6.0. Lead in urine and feces were similar for males and females.

The female subjects (both positive and control) worked in the same buildings with the control subjects for the garage attendants. From these data, it appears that females metabolize lead differently than do males.

7. A part of this study was to find out if short periods of time (1 to 9 days) away from work would alter body burdens of the five trace metals. The preliminary statistical treatment of the data indicates that the levels of the five trace metals were not changed as a result of a weekend or a short vacation.

8. Cadmium levels in urine appeared to reflect exposure to airborne cadmium for male subjects but not for females. The differences seen in hair and blood of males did not vary with the expected exposure gradient.

9. Future studies of the type reported here should include children and perhaps elderly people.

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TABLE I.
PROJECT 01-3451
ANALYSIS OF PARTICIPANTS
EXPOSED VS. CONTROLS

Participant Classification	Parameter	Parameter Grouping	Total Participants Exposed		Total Participants Controls		Smoker Participants Exposed		Smoker Participants Controls		Non-Smoker Participants Exposed		Non-Smoker Participants Controls	
1/1A Police	Age	18-26	10	(27)	(22)	9	6	(25)	(23)	6	4	(31)	(20)	3
		27-35	17	(46)	(49)	20	9	(38)	(38)	10	8	(62)	(63)	10
		36 -	10	(27)	(29)	12	9	(38)	(38)	10	1	(8)	(13)	2
	Education	0 - 12	13	(35)	(7)	3	9	(38)	(12)	3	4	(31)	(0)	0
		13-16	22	(59)	(32)	13	14	(58)	(42)	11	8	(62)	(13)	2
		Degree	2	(5)	(61)	25	1	(4)	(46)	12	1	(8)	(87)	13
	Ethnic	White	37	(100)	(93)	38	24	(100)	(92)	24	13	(100)	(93)	14
		Non-White	0	(0)	(7)	3	0	(0)	(8)	2	0	(0)	(7)	1
2/2A Garage Employees	Age	18-26	22	(69)	(37)	10	8	(53)	(38)	5	14	(82)	(45)	5
		27-35	7	(22)	(33)	9	5	(33)	(38)	7	2	(12)	(18)	2
		36-	3	(9)	(30)	8	2	(13)	(25)	4	1	(6)	(36)	4
	Education	0-12	16	(50)	(50)	13	8	(53)	(50)	8	8	(47)	(55)	6
		13-16	12	(38)	(35)	9	6	(40)	(44)	7	6	(35)	(18)	2
		Degree	4	(13)	(15)	4	1	(7)	(6)	1	3	(18)	(27)	3
	Ethnic	White	16	(50)	(44)	12	6	(40)	(38)	6	10	(59)	(55)	6
		Non-White	16	(50)	(56)	15	9	(60)	(63)	10	7	(41)	(45)	5
3/3A Females	Age	18-26	25	(74)	(67)	24	15	(79)	(71)	15	9	(60)	(60)	9
		27-35	7	(21)	(33)	12	3	(16)	(29)	6	5	(33)	(40)	6
		36-	2	(6)	(0)	0	1	(5)	(0)	0	1	(7)	(0)	0
	Education	0-12	2	(6)	(8)	3	2	(11)	(5)	1	0	0	(13)	2
		13-16	13	(38)	(19)	7	10	(53)	(24)	5	3	(20)	(13)	2
		Degree	19	(56)	(72)	26	7	(37)	(71)	15	12	(80)	(73)	11
	Ethnic	White	33	(97)	(94)	34	18	(95)	(100)	21	15	(100)	(87)	13
		Non-White	1	(3)	(6)	2	1	(5)	(0)	0	0	(0)	(13)	2

Numbers in parentheses are percentages

TABLE II. SCHEMATIC ANALYSIS OF PARTICIPANTS

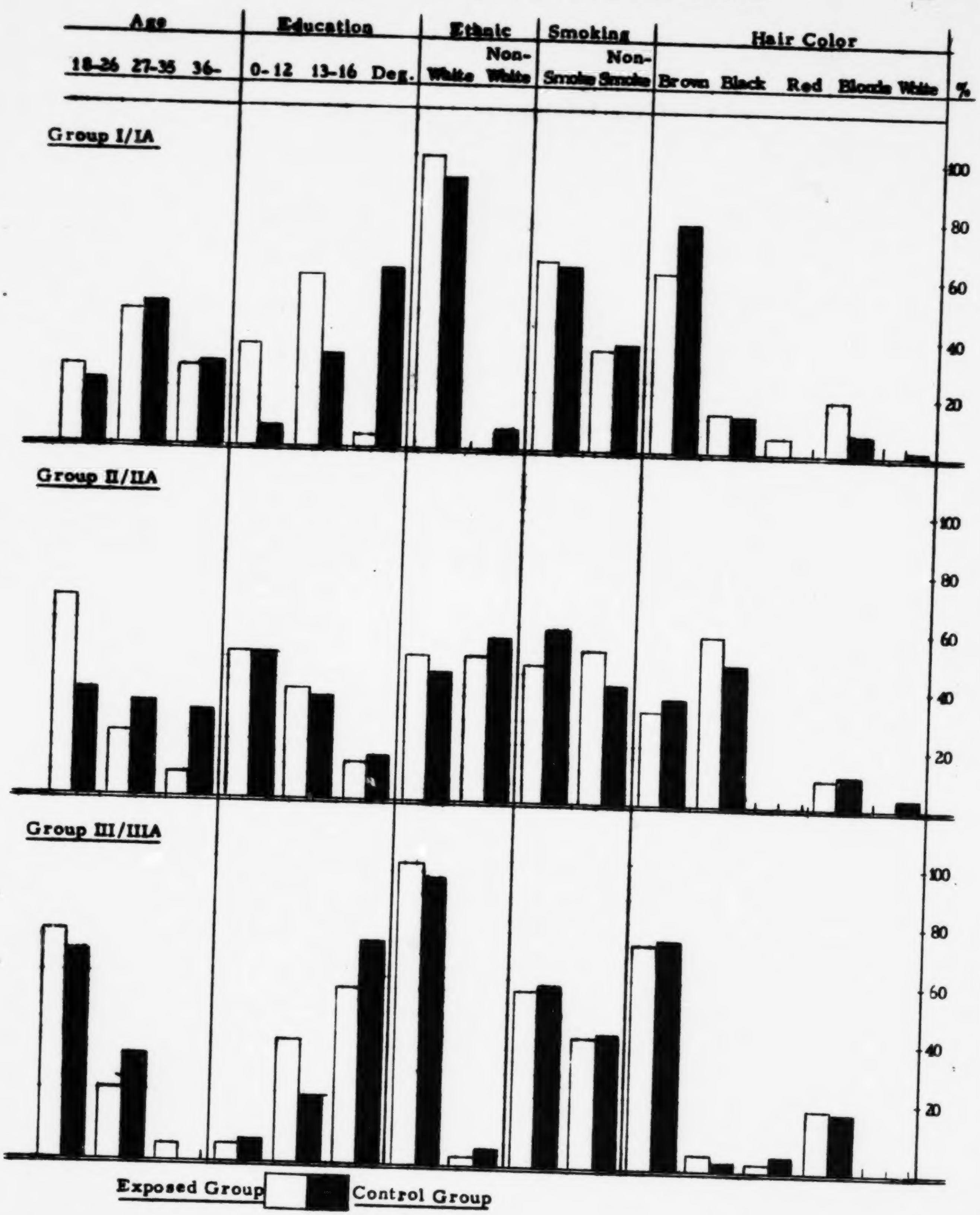

TABLE III. MEDIAN AGE OF SUBJECTS

Group	Median	Range
1	31	20-46
1A	30	19-53
2	25	18-45
2A	30	22-50
3	26	18-47
3A	25	21-32

TABLE IV. COPPER

	BLOOD µg/100ml			URINE µg/liter			HAIR µg/g		
Grp.	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size
1	63.1	19.69	139	8.8	5.35	142	12.5	6.34	136
1A	74.8	14.06	153	7.6	4.93	153	14.1	7.98	153
2	66.9	17.34	119	7.4	6.47	113	12.8	8.62	72
2A	57.8	18.01	98	8.7	5.68	98	14.7	7.89	99
3	96.3	31.06	118	13.5	8.94	110	32.0	24.75	104
3A	74.1	20.81	134	12.4	7.45	128	27.4	28.30	126

*Arithmetic mean

Statistical Differences Between Groups (All Tests)

	BLOOD		URINE		HAIR	
	Sig. p=.05	tc	Sig. p=.05	tc	Sig. p=.05	tc
1 vs 1A	yes	-5.8738	yes	2.0259	no	-1.8748
2 vs 2A	yes	3.7841	no	-1.4762	no	-1.4581
3 vs 3A	yes	6.7258	no	1.0134	no	1.2813

TABLE V. COPPER

	Test	GROUPS					
		1	1A	2	2A	3	3A
	1	87.6	78.6	74.4	51.8	96.2	74.6
Blood	2	57.3	74.9	75.3	47.8	103.0	69.3
μ g/100 ml	3	53.0	71.3	60.0	47.1	101.1	75.1
	4	55.0	74.5	57.5	83.9	84.1	76.1
	1	9.3	7.7	8.5	5.4	10.5	9.3
Urine	2	7.8	7.7	9.1	8.8	12.2	11.9
μg/liter	3	9.6	6.9	5.8	9.7	13.8	13.9
	4	8.3	8.0	6.1	10.9	18.1	15.4
	1	13.3	14.2	13.1	16.2	29.8	30.2
Hair	2	12.6	14.3	12.5	13.7	31.0	26.5
μg/g	3	12.8	14.3	13.2	15.3	29.5	25.2
	4	11.5	13.8	12.7	13.6	37.3	27.8

TABLE VI. COMPARISONS OF TESTS WITHIN GROUPS - Copper

		Test 1 vs Test 2 significant p=.05	Test 3 vs Test 4 significant p=.05
Blood	1	yes	--
	1A	--	--
	2	--	--
	2A	--	-yes
	3	--	yes
	3A	--	--
Urine	1	--	--
	1A	--	--
	2	--	--
	2A	-yes	--
	3	--	--
	3A	--	--

TABLE VII. MANGANESE

	BLOOD µg/100ml			URINE µg/liter			HAIR µg/g		
Grp.	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size
1	2.0	1.22	139	6.6	4.39	142	3.5	4.65	127
1A	2.7	1.85	153	7.8	8.94	153	2.9	3.23	146
2	2.4	.97	117	5.3	5.79	115	7.9	10.44	66
2A	2.1	.88	95	10.1	9.80	98	7.6	6.76	82
3	2.1	.77	117	12.2	12.42	110	3.4	2.88	105
3A	2.4	.93	132	8.4	11.44	117	7.0	18.44	119

*Arithmetic mean

Statistical Differences Between Groups (All Tests)

	BLOOD		URINE		HAIR	
	Sig. p=.05	tc	Sig. p=.05	tc	Sig. p=.05	tc
1 vs 1A	yes	-3.9830	no	-1.4813	no	1.2004
2 vs 2A	no	1.9402	yes	-4.3677	no	.2526
3 vs 3A	yes	-2.6090	yes	2.4428	yes	-1.9745

TABLE VIII.MANGANESE

	Test	GROUPS					
		1	1A	2	2A	3	3A
Blood µ g/100 ml	1	2.2	3.1	2.1	2.7	2.1	2.5
	2	2.1	2.8	2.5	2.1	1.8	2.6
	3	2.1	2.6	2.2	2.0	2.0	1.9
	4	1.6	2.6	2.7	1.7	2.4	2.3
Urine µg/liter	1	5.0	12.6	5.7	5.0	14.0	15.0
	2	6.2	10.3	4.4	9.3	9.4	3.4
	3	4.6	3.2	5.7	14.4	8.8	9.6
	4	10.7	5.3	5.6	11.7	17.1	4.7
Hair µg/g	1	4.1	2.9	7.6	6.5	3.6	8.3
	2	3.2	2.7	6.8	7.9	2.8	6.4
	3	3.8	2.8	8.9	7.3	3.4	6.2
	4	2.9	3.3	8.9	8.5	3.8	7.3

TABLE IX. COMPARISONS OF TESTS WITHIN GROUPS - Manganese

		Test 1 vs Test 2 significant p=.05	Test 3 vs Test 4 significant p=.05
Blood	1	--	yes
	1A	--	--
	2	--	--
	2A	--	--
	3	--	--
	3A	--	--
Urine	1	--	- yes
	1A	--	- yes
	2	--	--
	2A	- yes	--
	3	yes	--
	3A	yes	yes

TABLE X. ZINC

	BLOOD µg/100ml			URINE µg/liter			HAIR µg/g		
Grp.	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size
1	339.9	51.26	141	305	186.8	141	171.0	47.56	127
1A	306.5	45.99	153	308	186.1	154	172.3	45.77	154
2	317.5	70.92	117	449	251.4	109	173.4	109.88	72
2A	309.9	59.61	98	218	131.8	96	166.2	99.93	99
3	254.3	49.73	116	167	112.6	112	221.2	72.26	105
3A	251.4	66.06	132	177	106.7	125	250.1	114.76	126

*Arithmetic mean

Statistical Differences Between Groups (All Tests)

	BLOOD		URINE		HAIR	
	Sig. p=.05	tc	Sig. p=.05	tc	Sig. p=.05	tc
1 vs 1A	yes	5.8747	no	- .1108	no	- .2303
2 vs 2A	no	.8411	yes	-8.0978	no	.4364
3 vs 3A	no	.3850	no	- .7280	yes	-2.2429

TABLE XI. ZINC

	Test	GROUPS					
		1	1A	2	2A	3	3A
Blood µ g/100 ml	1	354.4	340.8	278.6	329.7	280.7	247.5
	2	369.7	294.9	311.2	299.4	234.3	210.1
	3	316.8	272.2	343.2	308.1	236.1	259.3
	4	317.8	314.9	339.1	304.1	265.5	297.3
Urine µg/liter	1	196.	260.	505.	190.	141.	215.
	2	220.	332.	496.	181.	180.	172.
	3	455.	251.	470.	278.	186.	151.
	4	358.	392.	304.	223.	163.	164.
Hair µg/g	1	174.3	168.7	197.7	186.6	206.0	243.2
	2	167.0	185.2	182.6	173.7	236.3	253.8
	3	168,7	167.7	153.8	148.4	228.8	259.4
	4	174.2	167.5	151.5	156.5	220.6	244.4

TABLE XII. COMPARISONS OF TESTS WITHIN GROUPS - Zinc

		Test 1 vs Test 2 significant p=.05	Test 3 vs Test 4 significant p=.05
Blood	1	--	--
	1A	yes	- yes
	2	--	--
	2A	--	--
	3	yes	- yes
	3A	yes	- yes
Urine	1	--	yes
	1A	– yes	- yes
	2	--	yes
	2A	--	--
	3	--	--
	3A	--	--

TABLE XIII. CADMIUM

	BLOOD µg/100 ml			URINE µg/liter			HAIR µg/g		
Grp.	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size
1	.5	.67	139	1.4	1.05	142	1.1	2.09	119
1A	.7	.85	155	.6	.44	155	1.1	2.02	150
2	.5	.52	120	.8	.63	114	1.0	.97	71
2A	.4	.44	98	.5	.23	98	2.2	2.10	98
3	.9	1.1	120	.6	.67	110	.6	.41	101
3A	.8	1.7	135	.6	.40	117	.7	.55	113

*Arithmetic mean

	FECES µg/g		
Grp.	Mean*	Std. Dev.	Sam. Size
1	.19	.07	141
1A	.20	.11	130
2	.30	.21	93
2A	.24	.13	98
3	.27	.16	105
3A	.23	.13	124

Statistical Differences Between Groups (All Tests)

	BLOOD		URINE		HAIR		FECES	
	p=.05	tc	p=.05	tc	p=.05	tc	p=.05	tc
1 vs 1A	yes	-2.7122	yes	8.7999	no	.1073	no	-1.0536
2 vs 2A	yes	2.4093	yes	5.1880	yes	-4.4842	yes	2.3505

TABLE XIV.CADMIUM

	Test	GROUPS					
		1	1A	2	2A	3	3A
Blood µg/100 ml	1	.7	.6	.8	.5	.9	1.7
	2	.6	.4	.8	.5	1.0	.7
	3	.4	.4	.3	.2	.9	.3
	4	.4	1.6	.3	.2	.9	.2
Urine µg/liter	1	2.5	.7	1.1	.5	.3	.6
	2	1.2	.5	.9	.5	.8	.8
	3	1.1	.5	.8	.5	.5	.5
	4	1.0	.9	.5	.5	.8	.6
Hair µg/g	1	1.1	1.1	0.9	2.4	.6	.7
	2	1.0	1.1	1.0	2.5	.6	.6
	3	1.3	1.0	1.0	2.1	.6	.7
	4	1.1	1.4	1.2	1.9	.6	.7
Feces µg/g	1	.17	.21	.24	.23	.31	.22
	2	.18	.22	.23	.22	.23	.19
	3	.19	.21	.44	.27	.26	.27
	4	.21	.16	.27	.22	.26	.24

TABLE XV. COMPARISONS OF TESTS
WITHIN GROUPS - Cadmium

		Test 1 vs Test 2 significant p=.05	Test 3 vs Test 4 significant p=.05
Blood	1	--	--
	1A	--	-yes
	2	--	--
	2A	--	--
	3	--	--
	3A	yes	--
Urine	1	yes	--
	1A	yes	-yes
	2	--	yes
	2A	--	--
	3	-yes	-yes
	3A	--	--

TABLE XVI. LEAD

	BLOOD μg/100 ml			URINE μg/liter			HAIR μg/g		
Grp.	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size	Mean*	Std. Dev.	Sam. Size
1	23.1	9.21	141	24.8	21.89	144	23.5	38.61	136
1A	18.4	7.38	150	19.0	19.64	160	13.1	15.92	149
2	28.3	10.33	119	26.5	25.38	124	47.6	46.42	73
2A	21.3	9.70	95	27.8	19.80	100	29.7	29.62	100
3	12.9	4.47	120	32.0	25.47	120	7.4	10.61	106
3A	11.9	4.28	117	19.5	21.25	144	6.0	5.51	121

*Arithmetic mean

	FECES μg/g		
Grp.	Mean*	Std. Dev.	Sam. Size
1	2.5	2.87	141
1A	2.3	2.72	125
2	2.4	1.68	92
2A	2.2	2.44	96
3	2.9	2.18	105
3A	2.7	3.94	123

URINE Coproporphyrin μg/100 ml		
Mean	Std. Dev.	Sam. Size
3.1	2.55	144
3.5	2.56	160
3.8	4.22	124
3.1	2.61	100
3.0	2.41	128
2.0	1.54	144

Statistical Differences Between Groups (All Tests)

	BLOOD		URINE		HAIR		FECES	
	p=.05	tc	p=.05	tc	p=.05	tc	p=.05	tc
1 vs 1A	yes	4.7726	yes	2.4464	yes	3.0185	no	.5648
2 vs 2A	yes	5.0098	no	-.4254	yes	3.0823	no	.4107
3 vs 3A	no	1.8926	yes	4.3452	no	1.2754	no	.3474

TABLE XVII. LEAD

	Test	GROUPS					
		1	1A	2	2A	3	3A
Blood µg/100 ml	1	25.0	18.3	29.6	17.4	12.6	13.0
	2	26.1	22.6	31.3	25.9	14.0	11.1
	3	17.3	17.6	25.8	22.4	12.1	11.1
	4	23.7	15.1	26.4	19.2	13.0	12.6
Urine µg/liter	1	39.1	20.6	11.9	32.4	28.3	19.6
	2	32.8	18.1	37.0	25.5	33.7	11.4
	3	20.0	21.6	28.7	22.7	36.3	26.9
	4	7.2	15.5	28.2	30.5	29.7	20.0
Hair µg/g	1	38.5	16.0	52.7	34.5	9.9	5.4
	2	21.7	12.9	47.2	30.3	9.3	6.3
	3	19.9	11.2	50.8	26.7	4.0	5.7
	4	13.1	12.3	38.3	27.4	6.1	6.5
Feces µg/g	1	2.5	2.6	2.3	3.2	3.5	2.5
	2	3.1	2.1	1.8	2.6	2.7	2.1
	3	2.0	2.4	2.4	1.6	2.5	2.7
	4	2.3	2.0	3.1	1.5	2.9	4.1

TABLE XVIII. COMPARISONS OF TESTS WITHIN GROUPS - Lead

		Test 1 vs Test 2 significant p = .05	Test 3 vs Test 4 significant p = .05
Blood	1	--	- yes
	1A	- yes	--
	2	--	--
	2A	- yes	--
	3	--	--
	3A	--	--
Urine	1	--	yes
	1A	--	--
	2	- yes	--
	2A	--	--
	3	--	--
	3A	yes	--

TABLE XIX. WATER ANALYSIS

Sample Identification	concentration in µg/liter Cd	Cu	Mn	Pb	Zn
Group 3 (Homes)					
No. 1	0.4	6	1.4	0	72
No. 2	1.1	74	10.3	2.5	48
No. 3	0.3	58	5.5	0	36
No. 4	0.3	0	6.8	0	462
No. 5	0.6	22	0.8	0.1	0
Average	0.5	44	5.0	0.5	124
Group 3A (Homes)					
No. 1	0.6	11	0.7	0	189
No. 2	0.3	12	2.2	0	144
No. 3	0.4	6	5.3	0.6	243
No. 4	0.2	7	12.7	0.7	513
No. 5	0.4	4	0.8	0	674
Average	0.4	8	4.3	0.7	353
Group 1					
Police Station	0.2	360	9.0	0	164
Group 1A					
City Hall	0.5	85	8.3	0.2	1113
Groups 2A, 3, 3A					
Baylor Col. of Med.	0.7	92	8.9	2.8	738
Methodist Hosp.	0.4	88	5.1	7.6	328

TABLE XX. DUST ANALYSIS

Sample Identification	Cd	Cu	Mn	Pb	Zn
	Concentration in μg/gram				
Group 3 (Homes)					
No. 1	0.5	3.1	4.7	6.3	16.2
No. 2	0.4	9.3	7.3	20.6	52.1
No. 3	0.3	5.9	5.8	4.9	17.2
Average	0.4	6.1	5.9	10.6	28.5
Group 3A (Homes					
No. 1	2.7	9.7	5.9	24.3	20.7
No. 2	0.3	4.3	9.8	4.6	14.6
No. 3	0.6	6.2	3.1	10.4	61.8
No. 4	0.4	5.0	2.9	9.8	25.3
No. 5	0.5	2.8	5.4	9.0	23.8
No. 6	0.3	3.3	3.0	9.4	28.7
Average	0.8	5.2	5.0	11.3	29.1

APPENDIX A

QUESTIONNAIRE FORM

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The questionnaire form used during the study to obtain information for selecting participants among those volunteering their services is presented in this Appendix. The form was designed to obtain the necessary information regarding address, occupation, health status, and personal statistics from each potential participant so that proper selection could be made. The form was designed for keypunching into two keypunch cards. Card 1 contains name and address data and Card 2 the occupation, health, and personal data required for the selection criteria employed. The numbers in parenthesis throughout the questionnaire form are the keypunch coding. Information obtained from the respective questions were punched in the columns specified in parenthesis in either Card 1 or Card 2, as indicated. A unique three-digit identification number was assigned to each potential volunteer for which a questionnaire was obtained, and the questionnaire form was labeled with this number. The unique ID number was keypunched into all data cards related to the volunteer subject and was used throughout all sampling procedures to label samples and results from a specific volunteer.

Specific instructions regarding keypunching the questionnaire form are given in the final three pages of this Appendix.

FORM APPROVED
By: Environmental
Protection Agency

CARD 1 (1)

I. D. #________
(2 - 4)

EXPOSURE TO FUEL ADDITIVES QUESTIONNAIRE

NAME:____
(5 - 24)

ADDRESS:____
Street (25 - 44) City (45 - 59) Zip (60 - 64)

TELEPHONE:____
(65 - 71)

Please write on the lines above - your full name, street address, city, Zip Code and telephone number (exclude Area Code).

The information requested in this questionnaire will be held in strict confidence.

P. E. G. 1 2 3 (72)
C. G. 11 22 33 (73 - 74)

CARD 2 (1)

I. D. # (2 - 4)

1. What is your present occupation? (5 - 6)

____.

2. Do you currently have a second full-time or part-time occupation in which you are frequently exposed to irritating smoke, dust, or fumes? (7)

   1. Yes
   2. No

IF YOU ANSWERED "NO" TO QUESTION "2", SKIP THE NEXT THREE QUESTIONS BELOW.

2a. If the answer to question 2 is "Yes," what kind of irritant are you exposed to? (For example: auto exhaust fumes, coal dust, cutting oils, smelter fumes, raw cotton dust.) (8 - 9)

____.

2b. If the answer to question 2 is "Yes," what kind of work do you perform in this job? (For example: maintenance, assembly line, supervisor.) (10 - 11)

____

____

2c. If the answer to question 2 is "Yes," how long have you been exposed to the irritant stated? (12)

   1. Less than one year
   2. One to five years
   3. Six to ten years
   4. More than ten years

3. Have you ever smoked as many as five packs of cigarettes, that is, as many as 100 cigarettes during your entire life? (13)

   1. Yes
   2. No

4. Do you now smoke cigarettes? (14)

   1. Yes
   2. No

5. If you are a current or an ex-cigarette smoker, how many cigarettes do (did) you smoke per day? (15)

   1. Less than 1/2 pack per day (1 - 5 cigarettes per day)
   2. About 1/2 pack per day (6 - 14 cigarettes per day)
   3. About 1 pack per day (15 - 25 cigarettes per day)
   4. About 1 - 1/2 packs per day (26 - 34 cigarettes per day)
   5. About 2 packs per day (35 or more cigarettes per day)

6. If you are a current or an ex-cigarette smoker, how old were you when you first started smoking? (16 - 17)

   ____________ Years

7. If you are an ex-cigarette smoker, how old were you when you last gave up smoking? (18 - 19)

   ____________ Years

8. What is your marital status? (20)

   1. Single
   2. Married
   3. Separated
   4. Divorced
   5. Widowed

9. What educational level has been completed by the head of the household? (21)

   1. Elementary School
   2. Part of High School
   3. High School Graduate
   4. Trade, Technical or Business School Beyond High School
   5. Part of College
   6. College Graduate
   7. Graduate School Including Advance and Professional Degrees

10. How long have you lived in your present city or town? (Check one answer only) (22 - 23)

1. Less than one year
2. One year
3. Two years
4. Three years
5. Four years
6. Five years
7. Six years
8. Seven years
9. Eight years
10. Nine years
11. Ten years
12. Eleven years
13. Twelve years or more

11. What was your age in years on your last birthday? (24 - 25)

____________ Years

12. What is your sex? (26)

1. Male
2. Female

13. What is the natural color of your hair? (27)

1. Brown
2. Black
3. Red
4. Blond
5. Gray
6. White

14. Have you ever had any of the lung related problems listed below? (Indicate all that apply). (28)

1. Asthma
2. Emphysema
3. Tuberculosis
4. Histoplasmosis
5. Bronchiectasis

15. **Have you ever had a thyroid problem?** (29)

    1. Yes
    2. No

16. **Do you live within two blocks of a freeway?** (31)

    1. Yes
    2. No

YOU HAVE FINISHED THE QUESTIONNAIRE

THANK YOU

17. DO NOT MARK BELOW THIS LINE

---

(32)

1.
2.
3.
4.

CARD #1

Item	Columns	Comments
Card #	1	The number 1 is punched in the column
ID#	2-4	Three Digit Number Assigned
Name	5-8 9-24	Initials Last Name
Address	25-64	As Shown
Telephone	65-71	As Shown

CARD #2

Item	Column	Comments
Card #	1	The number 2 is punched in this column
ID#	2-4	(The same as Card #1)
Q1-Occupation	5-6	1 - Policeman 2 - Attendant 3 - Custodian 4 - Orderly 5 - Clerk/Secretary 6 - Hospital Technician or Nurse 7 - Police Control Group 9 - Other
Q2-Other Emp.	7	As Shown
Q2a-Irritants	8-9	1 - Auto Exhaust 2 - Coal Dust 3 - Cutting Oils 4 - Smelter Fumes 5 - Raw Cotton Cust 6 - Cigarette/Cigar Smoke 7 - Other
Q2b-Duties	10-11	1 - Guard 2 - Maintenance 3 - Assembly Line 4 - Supervisor 5 - Waitress 6 - Sales 7 - Secretary 8 - Other
Q2c-How Long	12	As Shown
Q3-Have Smoked	13	As Shown
Q4-Do Smoke	14	As Shown
Q5-How Many	15	As Shown
Q6-When Started	16-17	As Shown
Q7-When Quit	18-19	As Shown

Card #2 (Continued)

Q8-Married	20	As Shown
Q9-Education	21	As Shown
Q10-Length Lived in Town	22-23	As Shown
Q11-Age	24-25	As Shown
Q12-Sex	26	As Shown
Q13-Color of Hair	27	As Shown
Q14-Lung Problems	28	As Shown (6 is key-punched for any multiple problem)
Q15-Thyroid	29	As Shown
Q16-Live Near Fwy	31	As Shown
Q17-Ethnic	32	1 - White 2 - Negro 3 - Mexican-American 4 - Other
Location Code	35	0 - Baylor College of Medicine 1 - Travis Garage 2 - HNG Garage 3 - Ten-Ten Garage 4 - 1st City Nat. Bk Garage 5 - Texas Nat. Bk of Commerce Garage 6 - Texas Medical Ctr Garage 7 - Houston PD 8 - Houston Civic Center 9 - Methodist Hospital
Group Identification	79-80	1/1A - Police/Police Control 2/2A - Garage/Garage Control 3/3A - Females/Females Control

APPENDIX B

INFORMATION SHEETS USED IN SURVEYS

STUDY TO MEASURE HUMAN EXPOSURE TO FUEL ADDITIVES

FOR The Environmental Protection Agency

BY Southwest Research Institute

AT Houston, Texas

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to measure human exposure to fuel additives. The design of this study is that certain trace metals will be measured in hair, blood and urine samples from people ordinarily exposed to relatively high levels of engine exhaust fumes and in individuals with lesser exposure to these pollutants.

To conduct this study, some two hundred and forty volunteer participants are needed. The following types of volunteers will be selected:

Policemen and City Office Staff

40 Daytime Shift, outside work, regular exposure to auto exhaust fumes

40 Any shift, indoors, away from regular exposure to auto exhaust fumes

Housewives, Nurses, Female Office Staff, Female Building Custodians

40 Living near (within two blocks) a freeway

40 Not living near a freeway

Male Garage Attendants

40 Working in area of covered auto garage

Male Building Custodians

40 Working away from regular exposure to auto exhaust fumes

The information obtained will assist the Environmental Protection Agency to assess the types and quantity of pollutants to which populations which make large use of freeways are exposed. This type of data is essential to insure that the air we and our children breathe is safe. Each participant will be informed of the results of the project when it is completed.

Samples will be collected four times during the project (4-6 months) for each of the three types: scalp hair, blood and urine. Samples will be taken after a work day, after a non-work day and before and after a vacation. A small amount of the participants' hair clippings will be saved at the time of normal hair cut. Participants will be given sample containers which can be mailed to us. The night before giving a blood sample the participants will collect all urine (in a contained supplied by us) beginning after supper (6-8 PM) and continuing until the next morning when a blood sample will be given (8 - 10 AM). Twenty milliliters of blood will be taken by a nurse and under a physicians supervision. All aspects of these experiments involving human subjects will be conducted in accordance with the PHS Surgeon General's issuance, "Protection of the Individual as a Research Subject" dated May 1, 1969. Each participant will be paid $25 for the complete study - that is, four samples of blood, urine and hair clippings.

INFORMATION REGARDING SOUTHWEST RESEARCH INSTITUTE

Southwest Research Institute is a public service organization devoted to applied research and franchised under the laws of the State of Texas as a not-for-profit corporation. A staff of 1150 persons at facilities in San Antonio, Houston, and Corpus Christi, Texas, Bloomfield, Connecticut, and Washington, D. C., provide a broad spectrum of highly competent personnel with professional, technical, and administrative training. The research activities of this institute include investigations into virtually all areas of physical, engineering, behavioral, or social sciences.

REFERENCES

Mr. George W. Bichsel, Associate City Manager, City of San Antonio, Texas

Mr. Robert J. MacDonald, Director of Intergovernmental Services,
City of San Antonio, Texas

SCHEDULE OF ACTIVITIES

STUDY TO MEASURE HUMAN EXPOSURE TO FUEL ADDITIVES

1. Initial Meeting with Employers
   - Employer Permission
   - Information Regarding Access to Bulletin Board, Auditorium, etc.
2. Advertisement of Study to Potential Participants
   - Bulletin Boards
   - Handouts
   - Employer Announcement
3. Meeting with Potential Participants to Fill Out Questionnaires
   - Information Regarding Study
   - Fill out Questionnaires
4. Selection of Participants
5. Initial Gathering of Samples Before and After a Work Day (Near Place of Work)
6. Gathering of Samples Before and After Vacation (At Southwest Research Institute Office, 3600 S. Yoakum Blvd., Houston, Texas 77006, Phone: 713-522-0726
7. Payment of 25 dollars to each participant completing study.

MAJOR STUDY POINTS

- 240 Volunteer Participants
- 4 Collections of Blood, Urine, Hair Clippings
- No Interference with Normal Work Activities
- $25 to Each Participant

EVERYONE TALKS ABOUT POLLUTION

HERE'S YOUR CHANCE TO HELP DO SOMETHING ABOUT IT

NEED 80 MALE VOLUNTEERS FOR A RESEARCH STUDY

HOUSTON PD - 40 DAYTIME SHIFT OUTDOORS (ON FOOT OR 3 WHEEL VEH.)
PASADENA PD - 40 ANY SHIFT INDOORS OR IN PATROL CARS

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to evaluate human exposure to fuel additives. The study will involve the measurement of certain metals in hair, blood and urine of subjects who in their normal course of work are exposed to exhaust fumes from internal combustion engines.

We need your assistance in contacting potential volunteers. The participation of these individuals in this study will not interfere with their jobs. We need male policemen between the ages of 18 and 45 who work a daytime shift outside. They should work primarily within the downtown Houston Area. At least 40 volunteers will be needed for this group. A control group of policemen (same age group) of at least 40 will also be required. These volunteers should have jobs that require them to spend most of their time indoors or in patrol cars. The control subjects will be from the Pasadena P. D.

Urine, blood and hair samples will be collected from each subject four times during the study. The subjects will be paid $25 for their services. Collection of samples will be under the supervision of a physician and the collections will be made outside of working hours. Information covering all aspects of the project will be supplied to the subjects. All aspects of these studies involving human volunteer subjects will be conducted in accordance with the PHS Surgeon General's issuance, "Protection of the Individual as a Research Subject", dated May 1, 1969.

EARN AN EXTRA $25

COMPLETE INFORMATION REGARDING THIS PROGRAM WILL BE GIVEN OUT

Where: Roll Call Area

When: 30 minutes preceding morning and afternoon roll call, Tuesday, October 17, 1972.

MALE OFFICE STAFF

EVERYONE TALKS ABOUT POLLUTION

HERE'S YOUR CHANCE TO HELP DO SOMETHING ABOUT IT

NEED 40 MALE VOLUNTEERS FOR A RESEARCH STUDY

- Work Inside
- Any Shift

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to evaluate human exposure to fuel additives. The study will involve the measurement of certain metals in hair, blood and urine of subjects who in their normal course of work are exposed to exhaust fumes from internal combustion engines.

We need your assistance in contacting potential volunteers. The participation of these individuals in this study will not interfere with their jobs. We need male office staff between the ages of 18 and 45 who are employed by the City of Houston. These volunteers should have jobs that require them to spend most of their time indoors away from auto emissions.

Urine, blood and hair samples will be collected from each subject four times during the study. The subjects will be paid $25 for their services. Collection of samples will be under the supervision of a physician and the collections will be made outside of working hours. Information covering all aspects of the project will be supplied to the subjects. All aspects of these studies involving human volunteer subjects will be conducted in accordance with the PHS Surgeon General' s issuance, "Protection of the Individual as a Research Subject", dated May 1, 1969.

EARN AN EXTRA $25

COMPLETE INFORMATION REGARDING THIS PROGRAM WILL BE GIVEN OUT

GARAGE ATTENDANTS

EVERYONE TALKS ABOUT POLLUTION

HERE'S YOUR CHANCE TO HELP DO SOMETHING ABOUT IT

NEED 40 MALE VOLUNTEERS FOR A RESEARCH STUDY

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to evaluate human exposure to fuel additives. The study will involve the measurement of certain metals in hair, blood and urine of subjects who in their normal course of work are exposed to exhaust fumes from internal combustion engines.

We need your assistance in contacting potential volunteers. The participation of these individuals in this study will not interfere with their jobs. We need males between the ages of 18 and 45 who work primarily within a covered parking lot. At least 40 volunteers will be required.

Urine, blood and hair samples will be collected from each subject four times during the study. The subjects will be paid $25 for their services. Collection of samples will be under the supervision of a physician and the collections will be made outside of working hours. Information covering all aspects of the project will be supplied to the subjects. All aspects of these studies involving human volunteer subjects will be conducted in accordance with the PHS Surgeon General's issuance, "Protection of the Individual as a Research Subject", dated May 1, 1969.

EARN AN EXTRA $25

COMPLETE INFORMATION REGARDING THIS PROGRAM WILL BE GIVEN OUT

Where:

When:

MALE HOSPITAL BUILDING CUSTODIANS

EVERYONE TALKS ABOUT POLLUTION

HERE'S YOUR CHANCE TO HELP DO SOMETHING ABOUT IT

NEED 40 VOLUNTEERS FOR A RESEARCH STUDY

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to evaluate human exposure to fuel additives. The study will involve the measurement of certain metals in hair, blood and urine of subjects who in their normal course of work are exposed to exhaust fumes from internal combustion engines.

We need your assistance in contacting potential volunteers. The participation of these individuals in this study will not interfere with their jobs. We need male building custodians between the ages of 18 and 45. At least 40 male volunteers will be needed and they will serve as a control group for comparison to results for males regularly exposed to exhaust fumes in their normal course of work.

Urine, blood and hair samples will be collected from each subject four times during the study. The subjects will be paid $25 for their services. Collection of samples will be under the supervision of a physician and the collections will be made outside of working hours. Information covering all aspects of the project will be supplied to the subjects. All aspects of these studies involving human volunteer subjects will be conducted in accordance with the PHS Surgeon General's issuance, "Protection of the Individual as a Research Subject", dated May 1, 1969.

EARN AN EXTRA $25

COMPLETE INFORMATION REGARDING THIS PROGRAM WILL BE GIVEN OUT

Where:

When:

NURSES, FEMALE OFFICE STAFF, AND FEMALE BUILDING CUSTODIANS

EVERYONE TALKS ABOUT POLLUTION

HERE'S YOUR CHANCE TO HELP DO SOMETHING ABOUT IT

NEED 80 FEMALE VOLUNTEERS FOR A RESEARCH STUDY

40 LIVING NEAR (WITHIN 2 BLOCKS) OF A FREEWAY
40 NOT LIVING NEAR A FREEWAY

Southwest Research Institute is conducting a study for the Environmental Protection Agency (EPA Contract No. 68-02-0595) to evaluate human exposure to fuel additives. The study will involve the measurement of certain metals in hair, blood and urine of subjects who in their normal course of work are exposed to exhaust fumes from internal combustion engines.

We need your assistance in contacting potential volunteers. We need females between the ages of 18 and 45 who live within 2 blocks of a freeway in the metropolitan Houston Area. At least 40 volunteers will be needed for this group. An additional 40 female volunteers (same age group) who do not live near a freeway and preferably live on the fringe of the metropolitan Houston Area.

Urine, blood and hair samples will be collected from each subject four times during the study. The subjects will be paid $25 for their services. Collection of samples will be under the supervision of a physician and the collections will be made outside of working hours. Information covering all aspects of the project will be supplied to the subjects. All aspects of these studies involving human volunteer subjects will be conducted in accordance with the PHS Surgeon General's issuance, "Protection of the Individual as a Research Subject", dated May 1, 1969.

EARN AN EXTRA $25

COMPLETE INFORMATION REGARDING THIS PROGRAM WILL BE GIVEN OUT

Where:

When:

APPENDIX C

LISTING OF RESIDENCE, EMPLOYMENT, HEALTH, SMOKING HABITS, AND PERSONAL DATA FOR VOLUNTEER PARTICIPANTS

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A listing of the keypunch card data for Card 2 (as defined in Appendix A) for all volunteer participants who successfully fulfilled the sample collections. The volunteer participants are identified by the assigned arbitrary three-digit ID number (columns 2-4) and this listing is ordered, numerically, regarding the ID number. Personal data for all human subjects on which the conclusions of this study are based are included in this listing. Conversely stated, data for persons who for some reason were not selected as participants or for some reason failed to complete the required sample collections (and, thus, were removed from the study data base) are not included in the listing.

APPENDIX D

CLINICAL DATA

Hematocrits

Coproporphyrin

Creatinine

Volume/Specific Gravity

Trace Elements - Blood
Cadmium, Copper, Lead, Manganese, Zinc

Trace Elements - Hair
Cadmium, Copper, Lead, Manganese, Zinc

Trace Elements - Urine
Cadmium, Copper, Lead, Manganese, Zinc

Trace Elements - Feces
Cadmium, Lead

Hematocrits

Coproporphyrin

Creatinine

Volume/Specific Gravity

HEMATOCRIT

GROUP NO. 1

I. D. No.	Test 1	Test 2	Test 3	Test 4
022	50	49	35	49
046	43	43.5	44	43
054	48	48	49	44
035	45	44	29	46
038	48	47	45	46
024	47	44	45	42
013	44	44	44	44
029	55	45	50	49
019	45	45	47	41
030	47	46	47	45
020	48	49	43	47
033	43	42	40	45
015	49	47	21	46
016	47	46	41	-
069	51	46	-	44
036	43	40	40	45
040	46	45	49	43
049	45	44	45	46
008	54	51	47	48
039	49	46	48	-
027	49	47.5	44	46
055	44	42.5	42	43
032	45	44	34	46
042	48	43	46	45
034	49	45	46	48
023	45	47	43	47
045	49	48	47	49
026	44	46	46	46
053	47	46	46	44
012	37	38	37	38
047	48	45	47	46
014	46	44	46	46
017	48	46	50	47
067	45	46	45	46
071	49	49	44	47
070	47	44	42	44

GROUP NO. 1A

I. D. No.	Test 1	Test 2	Test 3	Test 4
350	47	45	44	47
348	49	45	45	45
323	46	47	42	45
312	-	42	-	45
347	44	43	43	43
334	43	40	-	-
329	51	40	49	48
285	49	49.5	49	47
336	47	38	40	50
326	44	42	43	46
321	-	51	53	49
313	46.5	-	49	41
284	47	45	-	45
320	45	43	-	44
340	49	47	49	49
253	44	44	44	46
318	46	46	46	37
339	48	44	43	37
258	48	48	45	45
343	54	47	48	49
283	45	-	45	46
327	46	40	41	46
330	45	46	44	45
351	47	42	48	46
337	44	43	45	43
314	45	43	42	45
338	46	-	43	47
315	47	46	43	44
349	-	42	46	45
324	46	45	45	47
328	49	47	48	47
341	43.5	45	45	44
286	49	54	49	53
325	46	49	46	46
333	45	42	43	43
345	48	45	46	46
316	46	44	47	45
319	45	42.5	46	46
331	48	-	49	48

HEMATOCRIT

GROUP NO. 2

I. D. No.	Test 1	Test 2	Test 3	Test 4
503	46.5	45	43	58
279	55	53	58	63
264	48	46.5	47	48
004	55	52.5	53	55
273	50	49.5	47	50
281	44.5	45	45	45
003	45	45	42	45
001	-	43	40	45
504	43	44.5	42	43
502	44	46	42	44
269	44	43	39	45
270	45	44	42	44
262	45	44	42	-
266	46	44	43	-
405	51	50	49	52
066	44	45	41	-
402	45	41	43	44
058	49	47.5	49	48
404	46	47.5	44	47
006	46	48.5	46	47
005	47	47	43	42
065	42.5	42	43	53
276	50	50	49	-
002	50	53	51	47
501	46	47.5	45	48
275	46	49	46	51
278	51	51	46	51
061	47.5	46.5	44	45
505	48	49	47	48
277	50	48	44	47
271	47	45	45	45

GROUP NO. 2A

I. D. No.	Test 1	Test 2	Test 3	Test 4
246	43	42	40	42
298	48	46.5	42	48
259	47	46	46	49
307	47.5	35	48	50
291	47	47	45	43
287	41	40	42	38
248	46.5	47	47	41
299	36	40	47	43
303	45	45	46	34
401	42	42	42	41
304	39	41	44	-
309	34	45	44	38
249	44	44	44	39
257	46.5	49	39	45
305	45	44	48	44
288	48	-	44	46
400	46	42	44	42
251	45	44	44	44
255	40.5	41	39	42
292	-	45	46	43
290	41	40	41	37
261	43	45	43	46
250	46	45	46	43
301	40	40	42	-
601	42	48	48	48

HEMATOCRIT

GROUP NO. 3

I. D. No.	Test 1	2	3	4
111	40	40	42	40
112	40.5	41	43	41
141	35	34	36	34
180	36	36.5	38	37
142	46	44	44	46
311	41	38	41	38
221	43.5	42	43	40
187	40	39	-	-
133	31	31	33	38
203	38	38	36	38
236	39	38	-	-
297	42	42	41	43
149	41	42	41	40
176	40	38	-	41
080	40	41	42	39
161	40	41.5	45	43
177	39	36	40	39
600	41	42	43	41
110	38	39	-	38
139	32	35	34	34
230	41	35	40	39
129	40	41	42	40
204	46	45	43	39
296	35	37.5	37	47
222	42	42.5	-	35
094	37	37	40	38
210	43	41	40	43
098	45	37	39	39
122	38.5	40.5	40	45
224	42.5	41	43	39
294	38	40	-	-
295	44	45	-	-

GROUP NO. 3A

I. D. No.	Test 1	2	3	4
091	41	39	38	44
131	40	42	-	-
165	37	40	40	41
227	43	43	41	41
083	38	39	41	41
245	39	38	39	40
136	39.5	40	38	39
215	42	43	39	-
160	37	37	-	-
120	43	43	44	41
097	39	38.5	39	42
226	40	38	41	44
213	37	40	36	35
126	41.5	42	-	43
229	43.5	40	42	41
195	36.5	35	36	36
233	41	41	43	40
175	40	40	37	40
157	38	40	42	39
209	41	40	41	42
188	38	39	45	34
225	36.5	38.5	36	40
134	39	37	42	42
166	38	39	-	-
125	38	38	38	37
170	38	-	39	41
123	36	38	37	39
182	37.5	40	36	37
214	42	43	39	-
186	42	43	42	43
172	43.5	42	40	-
244	40.5	40.5	42	44
234	40	37	39	39
118	38	37	-	44
109	37	38	-	39
169	37.5	38	41	-
206	40	39	-	-

URINE - Creatinine

mg/100 ml

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	67.9	125.6	117.0	75.2
054	148.7	84.3	127.6	100.3
038	116.9	136.1	95.7	125.4
029	120.7	113.4	88.3	65.2
030	119.0	146.3	49.4	102.8
020	103.0	189.7	129.4	127.9
033	135.1	136.1	120.5	145.5
016	194.6	177.4	76.4	47.6
069	73.5	150.5	----	----
036	94.1	198.1	83.4	160.6
040	122.8	144.2	146.4	160.6
008	173.9	154.7	88.5	77.7
039	63.3	164.8	99.7	190.7
027	161.7	175.3	57.4	92.8
032	102.2	175.3	100.4	155.5
042	108.5	90.6	56.1	40.1
023	147.3	169.0	82.1	26.1
026	204.7	185.5	146.7	95.6
053	122.8	30.8	81.4	82.8
012	55.3	51.4	85.3	72.7
047	44.8	92.7	41.8	143.0
014	108.5	164.8	45.7	145.5
017	89.9	196.0	132.6	138.0
071	206.8	181.6	67.7	125.4
(non smokers)				
046	91.3	131.9	135.1	97.8
035	119.0	74.2	61.8	47.6
024	150.8	181.6	88.0	107.9
013	180.6	217.4	233.3	130.4
019	144.5	144.2	50.2	125.4
015	168.0	144.2	106.1	165.6
049	122.8	154.7	109.6	140.5
055	118.6	127.7	83.8	82.8
034	46.9	76.3	29.0	62.7
045	114.4	102.9	74.2	75.2
067	151.5	247.4	108.8	125.4
070	106.4	105.0	70.0	148.0

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	110.3	158.1	206.5	70.1
348	214.0	139.6	239.5	127.4
347	46.3	156.1	253.6	129.5
329	189.7	98.6	277.3	121.0
336	163.3	172.5	264.5	174.2
321	110.3	112.9	179.0	97.7
313	44.1	28.7	151.1	29.7
284	125.7	195.1	254.2	180.5
320	105.9	149.9	120.3	108.3
340	114.7	174.6	254.9	118.9
253	174.3	---	38.1	101.9
318	139.0	131.4	54.9	40.3
339	156.6	195.1	258.8	180.5
283	123.5	78.0	255.1	93.4
337	267.0	76.0	84.5	45.0
346	102.7	82.1	----	----
314	119.1	135.5	152.2	118.9
315	147.9	162.2	209.3	110.4
349	78.0	90.3	135.8	78.6
286	88.3	43.1	55.9	40.3
325	184.8	146.3	305.2	118.9
333	176.6	174.6	229.6	110.4
345	110.9	73.9	156.3	38.2
316	119.1	154.0	63.7	180.5
331	154.0	88.3	167.2	104.0
(non smokers)				
323	200.8	225.9	262.8	159.3
312	260.6	156.1	292.0	150.9
347	46.3	156.1	253.6	129.5
334	192.0	193.0	144.9	----
285	211.8	----	202.8	140.2
326	141.2	92.4	163.3	106.2
258	118.3	123.2	186.2	97.7
343	176.5	205.4	271.9	116.8
327	133.5	108.8	283.2	108.5
330	39.0	63.6	164.1	63.7
351	201.3	225.9	266.9	131.7
338	176,7	---	178.3	74.3
324	127.3	92.4	271.9	89.2
328	195.1	215.6	283.0	106.2
341	188.9	149.9	190.2	93
319	195.1	203.3	195.1	[illegible]

URINE - Creatinine

mg/100 ml

Group 2	Test			
(smokers)	1	2	3	4
503	229.1	196.9	51.5	190.8
264	172.9	63.4	48.0	37.3
004	197.9	140.0	151.1	123.1
273	27.0	17.5	---	----
281	191.6	107.2	45.7	102.5
504	62.5	153.8	32.2	22.5
270	162.5	262.4	208.3	194.9
262	181.2	249.9	82.4	----
266	----	135.6	84.7	100.5
405	172.9	236.6	128.2	246.2
066	108.3	61.5	215.2	----
058	----	287.0	208.3	114.8
002	56.2	54.7	70.9	86.1
275	93.7	118.1	100.7	114.8
061	187.5	168.5	145.9	61.5
(non smokers)				
279	79.1	39.3	27.4	63.6
003	145.8	295.0	206.0	147.7
001	108.3	176.3	98.4	118.9
502	291.7	148.8	194.6	88.2
269	210.4	120.3	155.7	162.0
402	147.9	111.6	77.8	96.4
404	191.6	225.5	27.4	182.6
006	154.1	246.0	119.0	110.7
005	284.5	266.5	107.6	----
065	22.9	34.8	20.6	32.1
276	158.3	164.0	70.9	----
501	208.3	218.8	171.7	164.1
278	166.6	109.4	162.5	57.4
505	162.5	262.6	194.6	180.5
277	166.6	164.1	167.1	77.9
271	143.7	144.4	100.7	142.2

Group 2A	Test			
(smokers)	1	2	3	4
298	70.6	67.8	88.5	65.2
307	70.6	169.6	102.5	100.2
291	66.3	30.2	193.6	233.1
287	40.6	195.1	34.9	102.5
248	194.8	226.2	125.8	37.2
299	278.4	164.5	76.9	74.5
303	158.4	265.1	144.5	95.5
401	128.4	36.4	221.4	100.2
309	299.8	226.2	158.5	125.8
305	126.3	215.2	195.8	195.1
288	201.3	168.6	111.8	186.4
292	181.6	106.9	163.1	116.5
601	199.6	39.0	67.6	186.4
261	167.7	167.3	83.9	181.8
250	53.9	203.6	144.5	----
(non smokers)				
246	205.5	308.5	97.9	88.5
259	253.5	308.5	76.9	----
304	288.6	246.8	130.5	144.5
249	273.0	90.3	165.5	149.1
257	278.4	64.5	58.2	132.8
400	175.6	294.8	102.5	191.1
251	321.2	133.7	86.2	114.2
255	219.6	100.7	102.5	167.8
290	175.6	123.4	135.2	144.5
301	83.7	70.8	149.1	139.8

URINE - Creatinine

mg/100 ml

Group 3 (smokers)	Test 1	2	3	4
112	167.4	150.2	134.8	273.9
141	44.1	106.3	109.5	178.9
180	277.0	212.7	162.2	132.7
142	53.4	217.4	258.6	208.5
221	72.0	97.1	185.4	134.8
187	97.5	161.9	----	----
236	174.2	180.4	----	----
149	209.1	178.6	139.0	84.2
176	116.1	277.5	231.7	71.6
600	94.9	80.9	75.8	195.9
139	58.0	141.0	159.2	94.6
230	58.1	283.3	37.9	168.5
204	197.5	215.1	252.8	269.6
210	174.2	141.0	160.1	179.0
098	83.6	194.2	158.0	255.0
122	233.6	69.3	111.6	252.8

(non smokers)

111	278.8	231.2	126.4	139.0
311	90.6	122.5	111.6	130.6
133	134.7	254.4	88.4	210.6
203	148.7	120.2	80.0	----
297	130.1	----	126.4	109.5
080	174.2	96.8	153.8	120.0
161	183.5	129.5	----	153.8
177	197.5	---	126.4	168.5
110	199.8	173.4	103.2	69.1
224	92.9	168.8	111.6	187.4
129	69.7	124.9	103.2	252.8
296	230.0	219.7	210.6	273.9
222	125.4	[illegible]	179.0	42.9
094	144.0	80.9	115.8	130.6

Group 3A (smokers)	Test 1	2	3	4
091	31.3	39.7	19.0	50.9
131	54.1	99.2	----	----
227	133.9	114.1	196.3	135.8
245	98.7	124.1	247.2	189.4
226	19.9	4.9	212.3	53.0
126	148.1	52.1	89.1	201.5
229	156.7	100.1	157.0	201.5
195	62.6	91.8	212.1	201.5
233	94.0	63.2	80.6	97.6
175	71.2	69.5	148.5	144.2
157	110.9	144.1	180.3	167.6
209	173.8	---	196.3	167.6
188	185.2	91.8	63.6	233.4
123	46.4	19.5	82.7	57.2
182	193.7	147.8	---	212.1
214	136.7	91.8	---	----
186	39.8	32.2	44.5	106.0
172	113.9	176.2	70.0	----
244	113.1	101.6	133.9	161.6
109	101.6	129.3	157.0	219.4
169	83.1	97.0	129.3	----

(non smokers)

165	136.7	76.9	178.2	127.3
083	162.4	139.0	228.8	123.0
136	151.0	121.6	116.7	131.5
215	156.7	89.3	254.6	----
160	196.6	96.8	----	----
120	79.7	69.5	166.3	115.4
097	170.9	111.7	275.8	----
213	133.9	94.3	256.4	190.9
225	105.4	99.2	133.6	233.4
134	79.7	81.9	73.3	106.0
166	48.4	35.1	---	----
125	99.7	38.1	108.2	73.3
170	56.9	194.1	89.1	275.8
234	207.8	177.8	92.3	177.8
118	64.6	103.9	---	147.8

URINE - Coproporphyrin

µg/100 ml urine

Group 1	Test			
(smokers)	1	2	3	4
022	3.5	4.5	2.3	1.1
054	7.3	9.3	4.9	2.2
038	2.5	1.1	1.3	2.0
029	7.0	6.6	4.1	1.1
030	6.0	4.9	1.4	1.8
020	6.3	1.9	3.0	0.4
033	2.6	3.1	0.4	0.5
016	6.0	2.3	0.5	0.8
069	3.6	3.7	---	---
036	3.1	3.5	0.2	0.7
040	2.3	5.9	2.0	1.0
008	5.8	3.1	0.7	0.8
039	1.5	5.0	2.4	1.1
027	1.5	3.5	1.6	1.8
032	9.9	9.4	3.0	5.6
042	2.4	1.5	2.0	0.8
023	8.7	0.8	2.3	0.8
026	4.7	3.4	1.8	1.1
053	8.1	2.9	2.2	2.2
012	1.3	5.0	0.8	1.2
047	1.8	3.4	0.8	2.1
014	2.5	5.9	0.9	2.2
017	0.4	5.7	1.8	0.9
071	5.2	7.4	0.2	1.2

(non smokers)

046	3.0	3.2	2.2	2.0
035	9.7	1.1	1.2	0.5
024	3.3	3.0	1.4	1.5
013	6.4	7.8	4.1	2.9
019	10.0	2.4	3.3	1.0
015	4.2	2.1	0.9	1.0
049	2.5	3.3	0.8	0.4
055	8.4	11.2	2.1	1.1
034	1.0	2.9	0.4	1.2
045	5.7	3.7	1.2	0.8
067	9.6	9.5	4.0	2.2
070	3.1	3.2	1.0	1.4

Group 1A	Test			
(smokers)	1	2	3	4
350	2.1	4.9	4.4	1.5
348	4.0	4.5	1.9	1.8
347	2.5	7.5	1.9	2.4
329	1.3	4.4	2.2	4.8
336	7.9	3.3	1.3	3.6
321	9.4	4.4	4.4	6.9
313	1.0	1.3	0.9	0.9
284	5.6	6.1	5.3	1.6
320	4.3	7.1	4.7	3.2
340	3.0	7.1	2.6	3.9
253	1.3	---	2.0	3.3
318	4.0	8.5	1.1	2.2
339	4.2	2.8	1.5	2.3
283	6.1	5.0	2.7	5.7
337	1.1	2.5	2.7	2.6
346	2.5	0.3	---	---
314	2.8	4.5	3.7	1.8
315	3.8	4.5	1.2	0.8
349	1.2	6.3	1.9	6.8
286	3.0	2.8	1.5	1.1
325	2.2	7.4	5.3	1.8
333	8.1	1.3	3.9	4.7
345	2.1	6.1	2.6	1.5
316	1.8	8.9	1.4	5.5
331	3.3	5.6	1.1	1.9

(non smokers)

323	2.2	4.0	1.8	2.0
312	7.9	4.5	1.3	---
334	10.7	9.4	12.8	---
285	5.0	---	0.8	4.0
326	7.6	3.0	1.2	3.3
258	2.6	4.2	0.4	3.9
343	9.2	9.2	1.1	2.7
327	1.8	3.5	0.9	3.9
330	0.3	0.4	0.9	1.3
351	6.0	6.1	3.7	5.4
338	1.4	---	4.6	2.2
324	0.2	3.4	0.8	2.0
328	8.9	8.9	0.9	2.3
341	5.6	4.4	0.6	4.1
319	5.4	8.1	3.4	4.7

URINE - Coproporphyrin

µg/100 ml urine

Group 2	Test			
(smokers)	1	2	3	4
503	0.4	0.4	1.3	2.7
264	4.2	2.5	2.6	3.0
004	11.1	8.1	9.5	5.8
273	1.4	0.8	---	---
281	5.6	1.7	1.6	2.9
504	2.7	1.6	2.9	2.0
270	7.0	17.0	5.0	11.4
262	16.6	23.3	1.8	---
266	---	3.3	3.3	1.3
405	---	---	1.3	2.6
066	6.0	3.6	2.3	---
058	---	4.7	6.7	3.6
002	2.4	2.0	0.8	1.5
275	23.3	16.3	1.9	0.6
061	4.3	5.4	2.9	2.5
(non smokers)				
279	6.0	1.9	0.8	1.1
003	2.8	0.6	0.9	3.4
001	9.7	1.0	2.3	4.0
502	6.9	3.5	3.0	3.9
269	9.4	2.9	4.3	2.9
402	14.0	2.0	2.7	2.6
404	6.3	8.8	1.1	4.4
006	5.5	7.7	2.0	0.8
005	0.4	6.7	1.5	---
065	2.2	2.6	1.3	1.5
276	5.2	4.3	0.8	---
501	4.3	8.6	2.0	2.3
278	6.5	2.3	0.8	1.1
505	4.9	6.8	2.6	2.2
277	2.9	3.5	1.6	1.9
271	2.5	---	1.2	2.0

Group 2A	Test			
(smokers)	1	2	3	4
298	2.4	0.4	4.3	6.2
307	1.2	1.7	1.7	3.6
291	0.4	0.7	1.5	1.5
287	1.9	2.8	1.8	2.6
248	12.3	6.2	2.8	2.1
299	3.8	2.9	0.8	4.7
303	2.0	0.3	2.0	3.5
401	0.2	1.5	2.3	3.3
309	9.5	2.0	2.1	2.7
305	0.6	2.5	1.1	3.8
288	13.8	1.3	4.1	7.1
292	1.1	1.3	1.5	6.3
601	6.3	0.5	0.7	2.2
261	2.4	1.5	4.0	3.0
250	0.8	3.0	4.1	---
(non smokers)				
246	6.5	3.3	2.0	3.8
259	9.4	5.2	0.8	---
304	3.7	3.9	3.1	7.3
249	4.4	1.1	1.1	1.6
257	10.8	1.3	3.3	3.2
400	4.5	2.0	1.8	4.1
251	8.6	4.4	2.3	3.2
255	6.6	5.2	0.8	1.6
290	4.5	0.5	2.2	1.0
301	1.2	1.8	2.1	1.7

URINE - Coproporphyrin

µg/100 ml urine

Group 3	Test			
(smokers)	1	2	3	4
112	1.2	2.2	1.6	4.5
141	1.7	1.4	1.0	---
180	9.5	2.7	1.1	2.2
142	2.2	5.1	---	3.9
294	1.7	---	---	---
295	2.9	3.2	---	---
221	1.4	1.5	3.6	6.4
187	4.5	3.5	---	---
236	4.1	1.2	---	---
149	6.9	1.4	5.0	1.6
176	1.1	5.8	10.3	2.9
600	---	2.2	7.7	5.7
139	1.2	1.9	2.2	0.9
230	1.1	4.3	1.6	3.2
204	0.5	6.2	2.7	4.8
210	2.4	3.9	5.4	5.5
098	2.1	2.1	5.9	11.8
122	3.0	1.5	2.2	3.9

(non smokers)

111	8.2	3.2	3.2	3.5
311	3.2	3.2	1.2	4.6
133	6.8	2.5	2.2	2.3
203	1.9	1.9	1.8	---
297	2.2	---	7.0	2.3
080	1.7	1.1	8.5	1.6
161	4.5	3.6	---	3.0
177	2.7	---	4.3	1.9
110	8.8	1.7	6.4	---
224	0.5	0.7	0.8	0.5
129	3.8	3.0	3.2	6.8
296	2.1	3.7	3.5	6.8
222	1.9	4.8	5.8	2.3
094	2.1	2.5	2.7	3.9

Group 3A	Test			
(smokers)	1	2	3	4
091	0.4	0.8	0.9	2.9
131	1.2	2.0	---	---
227	1.2	1.2	2.6	2.5
245	2.0	2.3	4.0	2.3
226	0.8	0.2	0.8	0.5
126	1.8	1.7	2.0	2.0
229	1.5	0.8	3.6	4.4
195	1.8	2.5	3.6	4.1
233	1.8	1.1	0.8	2.2
175	3.3	1.6	2.0	3.4
157	0.9	1.3	1.5	3.0
209	1.6	---	2.7	5.1
188	3.6	2.1	2.6	6.5
123	0.6	0.4	2.6	1.8
182	0.9	6.1	---	1.9
214	1.6	3.1	---	---
186	4.4	0.8	3.2	5.0
172	1.6	6.7	4.4	---
244	1.8	1.5	3.5	1.9
109	2.3	2.1	---	---
169	2.5	0.4	---	---

(non smokers)

165	2.3	0.5	3.4	3.2
083	2.0	1.5	4.7	1.3
136	5.7	3.3	2.2	2.9
215	2.2	1.7	4.0	---
160	2.0	0.8	---	---
120	1.2	0.6	1.6	2.0
097	1.5	2.6	5.8	---
213	2.7	1.4	4.1	5.8
225	1.6	2.2	2.9	5.1
134	1.5	0.5	2.0	2.3
166	3.6	1.3	---	---
125	1.1	0.5	2.3	0.4
170	0.5	1.2	2.5	3.2
234	3.4	1.6	0.5	1.7
118	0.8	1.8	---	---

URINE

GROUP NO. 1

I. D. No.	Volume (ml) Test 1	Volume (ml) Test 2	Volume (ml) Test 3	Volume (ml) Test 4	Specific Gravity Test 1	Specific Gravity Test 2	Specific Gravity Test 3	Specific Gravity Test 4
022	965	598	958	1053	1.010	1.021	1.025	1.020
046	815	1044	672	1244	1.015	1.023	1.024	1.019
054	869	420	603	984	1.021	1.025	1.029	1.023
035	773	1154	831	1173	1.017	1.014	1.017	1.015
038	544	516	778	169	1.021	1.021	1.021	1.025
024	497	466	1001	871	1.019	1.023	1.015	1.024
013	437	278	308	419	1.025	1.035	1.031	1.028
029	774	902	227	762	1.022	1.024	1.025	1.020
019	639	1111	670	583	1.021	1.023	1.022	-
030	1367	904	1276	793	1.015	1.027	1.015	1.023
020	459	182	182	194	1.022	1.027	1.020	1.026
033	578	593	476	402	1.020	1.023	1.017	1.035
015	619	939	566	519	1.022	1.020	1.026	1.032
016	345	843	391	1184	1.020	1.020	1.023	1.015
069	657	525	-	-	-	1.020	-	-
036	614	750	819	505	1.026	1.031	1.012	1.034
040	699	764	445	408	1.023	1.024	1.028	1.028
049	574	899	585	856	1.025	1.024	1.025	1.030
008	674	641	531	897	1.015	1.021	1.017	1.016
039	734	644	474	383	1.008	1.023	1.020	1.032
027	759	485	188	745	1.025	1.028	1.016	1.023
055	869	1097	1332	984	1.019	1.018	1.013	1.023
032	1131	522	468	262	1.012	1.023	1.025	-
042	971	1535	1128	1381	1.013	1.008	1.008	1.011
034	1278	1025	1261	664	1.004	1.012	1.005	1.016
023	784	878	1221	1443	1.020	1.014	1.011	1.009
045	994	1171	952	1116	1.017	1.030	1.025	1.018
026	504	737	386	613	1.024	1.029	1.033	1.018
053	1028	1602	691	534	1.018	1.010	1.018	1.015
012	1554	1554	1329	1030	1.011	1.010	1.005	-
047	1417	470	1813	311	1.005	1.015	1.011	1.025
014	978	64[illegible]	1602	532	1.018	1.025	1.010	1.030
017	907	509	399	685	1.015	1.024	1.023	-
067	834	526	992	609	1.024	1.031	1.023	1.025
071	162	313	600	330	1.018	1.030	1.007	1.026
070	712	768	435	408	1.011	1.013	1.014	1.027

URINE

GROUP NO. 3A

I. D. No.	Volume (ml) Test 1	2	3	4	Specific Gravity Test 1	2	3	4
091	1933	740	1061	837	1.010	1.010	1.002	1.005
131	1000	570	-	-	1.010	1.018	-	-
165	737	650	315	292	1.024	1.020	1.020	1.019
227	481	588	299	699	1.027	1.028	1.028	-
083	444	802	456	842	1.017	1.015	-	1.013
245	308	307	209	240	1.025	1.026	1.022	1.025
136	345	267	355	266	1.023	1.025	1.014	1.020
215	445	453	442	-	1.022	1.024	1.022	-
120	736	698	373	709	1.019	1.015	1.023	1.020
097	325	301	130	-	1.025	1.030	1.025	-
226	2400	2400	2400	2400	1.000	1.002	1.001	1.005
213	211	340	281	447	1.026	1.029	1.028	1.024
126	533	886	1429	509	1.017	1.016	1.010	1.015
229	211	242	544	160	1.021	1.022	1.011	1.028
195	965	465	484	308	1.021	1.023	-	-
233	904	559	726	934	1.010	1.014	1.011	1.008
175	724	812	536	1150	1.015	1.012	1.015	1.014
157	397	445	298	522	1.019	1.022	1.028	1.030
209	224	-	163	356	1.028	-	1.010	-
188	507	471	607	277	1.024	1.024	1.016	1.025
225	452	537	240	206	1.025	1.019	1.018	1.025
134	1092	551	1175	1298	1.006	1.020	1.015	1.009
166	432	887	-	-	1.020	1.015	-	-
125	538	835	229	546	1.006	1.010	1.015	1.005
170	982	343	766	399	1.012	1.028	1.015	1.017
123	983	1173	590	475	1.005	1.010	1.009	1.007
182	333	107	-	418	1.027	1.025	-	1.024
214	805	469	-	-	1.015	1.025	-	-
186	1492	1593	1787	1337	1.015	1.010	1.010	1.011
172	898	126	925	-	1.012	1.026	1.011	-
244	965	576	376	278	1.010	1.011	1.014	1.014
234	315	254	520	285	1.027	1.030	1.019	1.029
118	749	629	-	510	1.014	1.010	-	-
109	477	437	384	329	1.013	1.022	1.017	1.025
169	174	[illegible]74	389	-	1.022	1.011	1.025	-

URINE

GROUP NO. 3

	Volume (ml)				Specific Gravity			
I. D.	Test				Test			
No.	1	2	3	4	1	2	3	4
111	325	358	216	532	1.020	1.017	1.015	1.014
112	305	310	357	444	1.030	1.030	1.027	1.027
141	800	217	106	86	1.007	1.013	1.028	1.031
180	278	234	273	469	1.020	1.020	1.035	1.026
142	470	511	35	278	1.008	1.015	1.034	1.025
311	795	496	710	639	1.025	1.028	1.022	1.020
221	740	887	302	330	1.015	1.011	1.030	1.014
187	276	146	-	-	1.025	1.018	-	-
133	626	310	616	256	1.017	1.021	1.022	1.022
203	597	616	760	-	1.010	1.025	1.013	-
236	471	273	-	-	1.018	1.027	-	-
297	430	-	574	681	1.021	-	1.019	1.017
149	786	316	323	652	1.019	1.026	1.018	1.013
176	474	398	307	872	1.009	1.023	1.022	1.016
080	460	712	823	728	1.027	1.023	1.021	1.016
161	266	590	-	365	1.020	1.017	-	1.027
177	664	-	813	395	1.019	-	1.026	1.020
600	207	736	1046	391	-	1.012	1.015	1.019
110	643	762	506	84	1.020	1.026	1.020	1.021
224	555	730	780	523	1.016	1.019	1.017	-
139	1093	897	366	479	1.014	1.018	1.021	1.016
230	760	367	1617	927	1.010	1.025	1.005	-
129	532	964	701	575	1.016	1.022	1.016	1.020
204	656	532	537	286	1.015	1.025	1.023	1.026
296	190	400	267	109	1.020	1.030	1.021	1.021
222	793	530	386	568	1.012	1.022	1.019	1.011
094	807	461	699	861	1.015	1.019	1.011	1.015
210	354	398	191	361	1.020	1.021	1.020	1.008
098	303	283	250	228	1.005	1.020	1.016	1.016
122	173	483	403	220	1.022	1.013	1.026	1.016

URINE

GROUP NO. 2A

I. D. No.	Volume (ml) Test 1	2	3	4	Specific Gravity Test 1	2	3	4
246	1179	632	1343	398	1.024	1.023	1.019	1.015
298	282	1300	595	252	1.010	1.006	1.011	1.014
259	352	421	640	-	1.022	1.012	1.012	-
307	1231	1040	619	1372	1.010	1.009	1.018	1.013
291	517	574	146	113	1.006	1.003	1.026	1.030
287	692	914	1366	1011	1.005	1.018	1.005	1.012
248	701	821	602	1170	1.010	1.015	1.020	1.005
299	799	224	510	815	1.009	1.007	1.007	1.009
303	506	713	621	585	1.022	1.020	1.018	1.016
401	705	730	425	743	1.016	1.024	1.025	1.020
304	815	1137	704	487	1.021	1.025	1.020	1.020
309	934	782	368	258	1.026	1.026	1.029	1.024
249	709	1127	455	796	1.020	1.020	1.031	1.019
257	780	2500	1325	320	1.014	1.012	1.009	1.010
305	690	476	585	488	1.014	1.028	1.027	1.015
288	345	265	44	198	1.023	1.022	1.024	1.018
400	1268	922	1196	968	1.012	1.016	1.015	1.020
251	518	644	760	581	1.025	1.023	1.019	1.021
255	914	738	812	617	1.010	1.022	1.021	1.016
292	378	869	278	989	1.027	1.010	1.020	1.010
290	1925	2400	955	1739	1.024	1.025	1.023	1.025
261	501	462	584	254	1.022	1.010	1.016	1.017
250	631	646	439	-	1.009	1.017	1.029	-
301	474	1258	608	1440	1.027	1.034	1.025	1.016
601	1273	888	539	584	1.013	1.003	1.010	-

URINE

GROUP NO. 2

I. D. No.	Volume (ml) Test 1	2	3	4	Specific Gravity Test 1	2	3	4
503	562	438	311	443	1.035	1.032	-	-
279	230	375	777	383	1.010	1.010	1.006	-
264	619	714	812	591	1.020	1.012	1.010	1.011
004	82	125	195	77	1.030	1.023	-	-
273	2400	2400	-	-	1.001	1.003	-	-
281	1095	1780	1862	1565	1.022	1.013	1.012	1.023
003	470	355	293	547	1.023	1.035	1.029	1.027
001	669	193	470	190	1.023	1.027	1.023	1.022
504	642	722	1420	1489	1.014	1.013	1.008	-
502	861	1473	842	1010	1.040	1.030	1.026	1.022
269	665	1201	492	445	1.030	1.023	1.022	-
270	522	382	260	361	1.023	1.027	1.026	1.027
262	465	557	957	-	1.027	1.026	1.012	-
266	926	699	958	774	1.012	-	1.008	-
405	825	-	1137	401	1.025	-	-	-
066	492	359	141	-	1.010	1.010	1.020	-
402	830	1188	757	535	1.019	1.015	1.015	-
058	-	864	395	645	-	1.020	1.027	1.011
404	1496	1145	1399	535	1.018	1.014	1.009	1.024
006	537	258	340	161	1.020	1.029	-	-
005	467	484	655	-	1.028	1.026	-	-
065	162	187	165	81	1.005	1.007	1.005	-
276	1352	1256	1197	-	1.025	1.014	1.011	-
002	674	1742	1897	1552	1.027	1.010	1.008	-
501	690	298	159	247	1.029	1.030	1.027	-
275	1251	938	1014	426	1.015	1.013	1.014	-
278	749	1479	535	1350	1.026	1.016	1.029	1.008
061	145	696	712	476	1.023	1.024	1.029	1.016
505	1263	795	648	330	1.032	1.032	1.027	-
277	529	529	407	1284	1.024	1.032	1.025	1.018
271	671	273	81	120	-	-	1.025	-

URINE

GROUP NO. 1A

I. D.	Volume (ml)				Specific Gravity			
	Test				Test			
No.	1	2	3	4	1	2	3	4
350	767	519	760	1037	1.015	1.023	1.012	1.017
348	394	880	858	553	1.020	1.023	1.015	1.016
323	474	357	391	435	1.029	1.028	1.030	1.030
312	340	375	240	41	1.034	-	1.033	1.028
347	497	363	460	174	1.005	1.022	1.010	1.015
334	228	279	425	-	1.022	1.030	1.017	-
329	581	744	451	592	1.025	1.028	1.027	1.027
285	391	-	360	170	1.024	-	1.011	1.024
336	340	553	451	454	1.027	1.026	1.035	1.033
326	873	1130	1020	908	1.014	1.011	1.007	-
321	980	676	1202	848	1.008	1.013	1.012	1.016
313	2400	2400	1727	1420	1.003	1.005	1.005	1.006
284	880	348	480	312	1.021	1.033	1.025	1.028
320	1036	790	757	690	1.015	1.020	1.015	1.023
340	589	380	631	780	1.019	-	1.019	1.020
253	533	-	581	794	1.017	-	-	-
318	1154	917	1628	1257	1.020	1.026	1.019	1.022
339	1068	716	939	741	1.023	1.020	1.020	1.030
258	622	534	640	395	1.015	1.023	1.015	1.022
343	553	594	514	500	1.020	1.026	1.011	1.027
283	355	294	627	469	1.019	1.019	1.020	1.022
327	756	755	516	660	1.013	1.018	1.026	1.022
330	254	711	106	131	1.003	1.019	1.009	1.010
351	491	284	441	299	1.027	1.026	1.020	1.030
337	491	557	444	550	1.025	1.021	1.014	1.016
314	1344	847	635	1029	1.015	1.020	1.018	1.021
338	496	-	426	485	1.021	-	1.027	1.022
315	558	564	756	614	1.022	1.022	1.016	1.020
349	1386	1130	822	1234	1.035	1.038	1.028	1.019
324	705	884	472	712	1.005	1.020	1.020	1.015
328	362	507	764	645	1.019	1.030	1.020	1.016
341	295	862	1000	488	1.024	1.020	1.012	1.026
286	1591	1284	1722	1331	1.009	1.010	1.003	1.009
325	652	268	196	421	1.021	1.026	1.025	-
333	344	460	363	553	1.025	1.025	1.025	1.016
345	1047	1160	1411	1462	1.019	1.017	1.013	1.008
316	594	721	159	406	1.014	1.027	1.005	1.027
319	363	354	821	382	1.027	1.025	1.012	1.020
331	879	1272	1329	968	1.018	1.015	1.009	1.017

Trace Elements in Blood

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BLOOD - Cadmium

µg/100 ml Blood

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	1.36	0.27	0.76	0.43
054	0.76	0.19	0.59	0.41
038	0.41	1.16	0.28	0.32
029	0.50	4.75	0.54	0.32
030	0.63	0.57	0.76	0.73
020	0.68	0.64	0.78	0.73
033	0.29	0.31	0.35	0
016	0.50	0.31	0.11	0.42
069	0.72	0.17	--	0.30
036	0.54	0.36	0.78	0.39
040	0.26	0.18	0.60	0.35
008	0.40	0.18	0.33	0.50
039	0.48	0.57	0	--
027	0.38	0.57	0.70	0.68
032	0.31	0.33	0.25	0.25
042	0.39	0.69	0.53	0.37
023	0.27	0.87	0.18	0.25
026	0.42	0.54	0	0.18
053	--	0.62	0.18	0.17
012	0.43	0.75	0.63	1.45
047	0.37	0.46	0.30	0.39
014	0.35	0.23	0	0.10
017	6.3	0.30	0.33	--
071	0.54	0.47	0	0.49
(non smokers)				
046	--	[illegible]	--	0.27
035	0.60	0.63	0.59	0.33
024	0.82	0.46	0.90	0.21
013	0.37	0.46	0.90	0.56
019	0.36	0.39	0.25	0.97
015	0.32	0.23	0.14	0
049	0.51	0.44	0.16	0.26
055	0.36	0.57	0.23	0.21
034	0.21	0.78	0.22	0.21
045	0.27	0.42	0	0.27
067	0.56	0.09	0.21	0.33
070	0.75	0.13	0	0.10

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	0.99	0	0.29	3.32
348	0.47	1.00	2.39	0.71
347	2.97	0	0.38	1.78
329	3.08	0.88	0.49	1.33
336	0.21	0	0.41	1.51
321	--	0.22	0.27	1.25
313	0.42	0.31	0.17	1.11
284	0.61	0	0.15	0.80
320	0.11	0.41	0.17	1.70
340	0.18	0	0.14	1.51
253	0.08	0	0.41	1.73
318	0.14	0	0.19	0.68
339	0.96	0	0.55	1.41
283	0.44	1.70	0.31	0.87
337	0.24	0.64	0.21	1.55
346	1.64	0.29	--	--
314	0.36	1.47	0.28	1.03
315	0.65	0.22	0.22	2.25
349	--	0.42	0.22	1.64
286	0.55	0.30	0.78	2.41
325	0.40	0.30	0.25	5.86
333	0.76	0.23	0.33	2.42
345	0.21	0.21	0.25	2.67
316	0.16	0	0.39	1.92
331	0.31	0.21	0.32	3.10
352	1.27	0.35	--	--
(non smokers)				
323	0.42	0	0	0.91
312	--	0.47	0.94	1.77
334	0.21	0	0.25	--
285	0.38	0.35	0.56	0.63
326	0.46	2.12	0.15	0.55
258	0.38	1.34	0.26	0.61
343	0.63	0	0.30	1.10
327	2.47	1.60	0.18	0.90
330	0.41	0	0.25	1.04
351	0.17	0.35	0.28	1.48
338	0.08	--	0.22	1.46
324	0.19	0.18	0.20	0.4[illegible]

BLOOD - Cadmium

µg/100 ml Blood

Group 2	Test			
(smokers)	1	2	3	4
503	0.47	0.65	0.48	0.14
264	0.91	1.27	0.38	0.27
004	0.42	0.74	0.26	0.30
273	0.62	0.82	0.26	0.27
281	1.84	1.35	0.17	0.23
504	1.13	--	0.39	0.19
270	0.22	0.50	0.30	0.30
262	1.55	0.32	0.27	--
266	0.28	0.92	0.39	--
405	0.33	0.51	0.25	0.32
066	0.77	0.96	0.29	--
058	0.75	0.82	0.40	0.29
002	0.32	0.37	0.34	0.16
275	0.46	0.89	0.26	0.25
061	0.99	0.62	0.21	0.28
(non smokers)				
279	0.42	3.17	0.15	0.12
003	1.09	0.44	0.31	0.12
001	--	0.62	0.36	0.17
502	0.39	1.17	0.23	1.25
269	0.84	0.44	0.21	0.21
500	0.25	--	0.20	--
402	0.92	0.59	0.33	0.17
404	0.41	0.32	0.23	0.20
006	0.24	0.32	0.16	0.21
005	0.53	2.39	0.59	0.12
065	0.34	0.48	0.13	0.21
276	0.36	0.85	0.14	--
501	0.90	0.66	0.15	0.15
278	0.51	1.05	0.20	0.22
505	3.03	0.55	0.22	0.44
277	1.64	0.57	0.17	0.17
271	0.93	0.62	0.09	0.13

Group 2A	Test			
(smokers)	1	2	3	4
298	0.39	0.15	0.22	0.23
307	0.14	0.25	0.25	0.31
291	0.29	0.29	0.26	0.15
287	0.24	0.29	0.26	0.09
248	0.28	0.94	0.51	0.17
299	0.09	0.43	0.20	0.17
303	0.32	2.14	0	0
401	0.42	0.46	0.20	0.33
309	0.54	0.25	0.41	0.20
305	0.18	0.15	0.23	0.18
288	0.25	0.25	0.23	0.24
292	--	0.36	0.28	0.20
601	--	0.15	0.54	0.35
261	0.37	0.99	0.23	0.69
250	0.17	0.99	0.20	0.29
(non smokers)				
246	0.52	1.73	0.11	0.16
259	0.44	0.46	0.08	0.14
304	0.86	0.33	0.36	0.19
249	2.86	0.69	0.31	0.09
257	2.31	0.35	0	0.31
400	0.32	0.55	0.28	0.20
251	0.15	0.21	0.15	0.18
255	0.26	0.25	0.34	0.31
290	0.36	0.31	0.11	0.29
301	0.11	0.15	0.18	0.12

BLOOD - Cadmium

µg/100 ml Blood

Group 3	Test			
(smokers)	1	2	3	4
112	0.22	0.17	0.66	0.72
141	0.19	0.17	0.70	0.46
180	0.29	0.15	0.84	0.87
142	1.28	0.64	0.37	1.79
294	2.00	0.44	--	--
295	0.18	0.32	--	--
221	0.11	2.48	0.96	1.07
187	2.61	0.23	--	--
236	0.24	0.17	--	--
149	0.91	0.14	0.72	1.22
176	0.97	1.47	0.75	0.33
600	0.30	0.18	1.03	1.92
139	0.48	0.18	0.56	1.92
230	0.18	0.49	0.49	1.18
204	0.36	3.63	0.76	2.51
210	0.30	2.25	1.20	0.26
098	0.44	1.23	0.89	0.97
122	0.50	0.51	0.61	0.24
(non smokers)				
111	5.27	1.18	1.34	0.59
311	0.18	0.36	0.78	0.94
133	3.71	1.04	0.90	1.18
203	0.93	0.25	1.00	2.11
297	0.30	0.20	0.74	0.39
080	0.18	[illegible]	1.02	0.61
161	1.27	31	0.89	0
177	[illegible]	1.02	0.77	0
110	0.36	0.14	1.47	0
224	2.84	0.49	0.69	0
129	0.24	3.02	0.78	0
296	0.42	0.66	1.03	2.51
222	0.18	8.70	1.03	1.63
094	0.42	0.77	1.50	0.37

Group 3A	Test			
(smokers)	1	2	3	4
091	0.86	0.25	0.17	0.14
131	0.30	0.58	--	--
227	0.93	0.24	0.47	0.19
245	0.63	3.02	0.30	0.12
206	1.86	0.30	--	--
226	0.29	0.60	0.23	0.47
126	0.33	0.56	0	0.21
229	2.04	0.93	0.28	0.16
195	0.79	0.44	0	0.10
233	9.31	0.36	0.28	0.16
175	0.69	0.40	0.28	0.11
157	2.20	0.73	0.49	0.13
209	0.26	1.09	0	0.21
188	2.56	0.59	0.25	0.40
123	1.70	0.50	0.39	0.27
182	0.34	0.23	0.16	0.62
214	0.59	--	0.20	--
186	0.32	0.18	0.62	0.24
172	0.59	2.52	0.16	0.27
244	0.98	0.32	0.35	0.24
109	0.20	0.34	0.16	0.31
169	0.43	0.46	0.11	--
(non smokers)				
165	0.76	0.22	0.21	0
083	1.20	0.86	0.34	0.11
136	0.33	0.33	0.57	0.24
215	14.63	0.53	0.30	--
160	9.31	0.71	--	--
120	0.43	0.47	0.42	0.14
097	0.08	0.30	0.34	0.12
213	0.35	0.52	0.38	0.18
225	1.74	0.41	0.43	0
134	0.46	0.29	0.64	0.33
166	2.56	3.58	--	--
125	1.00	0.18	0.27	0.33
170	0.38	0.25	0.23	0
234	0.21	0.27	0.14	0.60
118	2.64	1.71	--	0.22

BLOOD - Copper

µg/100 ml whole blood

Group 1 (smokers)	Test 1	 2	 3	 4
022	82.9	86.7	64.6	49.3
054	93.4	55.2	-	53.3
038	72.0	49.9	43.9	37.3
029	99.2	76.2	58.8	44.7
030	77.0	85.0	60.5	41.3
020	65.0	55.4	50.5	76.9
033	115.5	54.4	44.7	51.0
016	82.9	45.7	70.4	63.0
069	79.4	62.2	-	51.9
036	108.5	82.6	67.1	60.2
040	75.9	55.4	57.2	42.6
008	73.5	37.9	37.3	67.1
039	77.0	40.8	39.7	-
027	87.5	53.1	54.0	48.3
032	95.7	55.5	54.0	53.0
042	85.2	57.2	57.2	93.0
023	96.9	58.0	54.0	64.0
026	72.4	53.1	48.5	65.0
053	-	46.6	42.1	61.0
012	91.0	75.2	79.2	101.0
047	110.9	51.7	59.6	62.0
014	78.2	51.7	46.6	60.0
017	93.4	54.2	48.2	51.0
071	99.2	73.3	50.6	75.0
(non smokers)				
046	-	49.9	38.1	40.0
035	107.0	42.9	64.6	46.0
024	70.0	42.1	50.5	40.7
013	119.0	77.1	79.0	58.7
019	61.9	47.3	57.2	29.3
015	92.2	65.1	63.0	52.8
049	108.5	48.6	38.9	39.4
055	58.4	55.5	36.5	44.0
034	75.9	58.8	47.7	63.0
045	75.9	49.8	42.1	51.0
067	107.4	55.8	52.3	40.0
070	95.7	53.3	43.3	47.0

Group 1A (smokers)	Test 1	 2	 3	 4
350	74.0	72.0	75.2	75.4
348	79.5	78.1	77.3	63.8
347	86.4	93.7	61.2	70.8
329	86.4	112.9	63.4	69.6
336	108.3	112.9	91.3	80.0
321	-	99.9	82.7	93.5
313	85.0	96.7	69.8	88.8
284	55.2	62.3	59.1	65.1
320	58.6	74.1	80.6	85.2
340	71.8	69.8	55.9	73.4
253	106.1	74.1	69.8	73.4
318	65.2	93.4	66.6	76.9
339	72.9	67.7	91.3	76.9
283	70.7	56.9	66.8	78.5
337	65.5	69.2	72.2	89.8
346	62.3	51.9	-	-
314	85.9	68.2	83.2	80.7
315	82.7	73.3	78.8	75.1
349	-	66.1	65.7	73.9
286	69.1	42.0	63.4	69.6
325	62.1	54.0	60.1	60.3
333	79.7	72.0	69.8	75.4
345	75.0	56.0	72.0	83.5
316	76.2	61.0	65.5	69.6
331	72.6	75.0	92.4	55.7
(non smokers)				
323	97.4	85.3	62.3	66.1
312	-	75.7	72.0	63.8
334	87.8	81.7	66.6	-
285	74.0	73.3	60.1	96.3
326	120.7	116.5	68.7	95.1
258	65.2	72.0	70.0	75.8
343	78.4	63.4	55.9	42.6
327	106.1	52.9	65.5	63.7
330	62.3	73.3	106.2	76.2
351	70.9	100.7	68.9	66.0
338	67.7	-	64.6	75.1
324	78.4	61.0	67.8	74.2
328	97.7	77.0	83.8	94.0
341	83.2	77.0	67.7	66.1

BLOOD - Copper

µg/100 ml whole blood

Group 2	Test				Group 2A	Test			
(smokers)	1	2	3	4	(smokers)	1	2	3	4
503	77.3	74.3	58.0	57.1	298	67.9	55.1	57.3	102.1
264	59.0	71.2	41.0	50.8	307	44.7	63.1	45.8	82.4
004	143.5	102.8	67.8	65.3	291	51.4	42.8	41.5	76.6
273	67.2	65.1	53.5	50.8	287	43.9	37.0	42.2	80.0
281	77.3	60.0	57.1	60.7	248	39.8	38.4	43.0	60.3
504	62.1	----	47.3	49.8	299	67.1	54.4	53.0	88.2
270	68.4	63.2	64.2	77.9	303	55.5	47.1	51.6	91.6
262	58.0	65.8	44.6	----	401	47.2	49.3	58.0	89.3
266	74.4	44.1	53.5	----	309	71.3	66.0	60.8	110.2
405	56.3	80.5	55.3	58.0	305	50.5	43.5	48.8	75.4
066	77.9	77.9	75.8	----	288	46.4	51.6	46.7	81.2
058	68.4	91.8	68.7	63.2	292	----	57.3	43.9	100.5
002	----	105.1	58.0	49.3	601	----	39.2	41.7	100.5
275	60.0	58.0	53.2	51.7	261	44.7	55.1	48.8	70.9
061	81.4	87.9	69.4	64.3	250	45.6	45.7	50.9	98.0
(non smokers)					(non smokers)				
279	64.1	67.2	55.3	50.8	246	53.0	43.5	41.5	71.9
003	86.5	103.8	67.8	70.7	259	49.7	39.9	40.1	67.3
001	----	63.1	54.4	54.4	304	69.6	50.0	48.8	89.3
502	66.1	78.4	57.1	54.4	249	48.1	49.3	46.0	82.4
269	108.9	61.5	66.9	58.0	257	48.9	54.5	45.3	80.0
500	88.3	----	45.5	----	400	46.4	40.6	43.1	68.4
402	42.4	46.7	60.7	67.5	251	44.7	39.9	43.9	68.4
404	93.5	77.0	97.3	70.1	255	55.5	42.1	51.6	76.6
006	64.1	60.6	52.3	50.2	290	47.4	50.8	46.7	104.4
005	87.5	77.9	65.6	60.6	301	52.2	39.9	37.5	82.5
065	87.5	89.7	66.6	63.2					
276	67.2	47	37.1	----					
501	53.9	.8	48.5	41.5					
278	58.0	5.2	59.0	38.4					
505	93.6	126.0	84.6	51.7					
277	61.2	64.3	68.5	57.2					
271	71.2	82.5	64.7	65.8					

BLOOD - Lead

µg/100 ml whole blood

Group 1	Test			
(smokers)	1	2	3	4
022	26.7	40.2	23.2	35.5
054	22.8	39.1	17.9	29.3
038	26.7	16.4	16.9	23.4
029	20.3	20.3	15.6	15.7
030	23.1	23.1	13.8	18.7
020	20.8	22.4	20.7	16.2
033	24.4	26.6	12.0	16.7
016	25.3	36.7	9.3	15.3
069	38.9	27.6	----	9.3
036	18.3	46.1	18.9	15.7
040	21.7	16.2	14.4	17.7
008	30.6	20.5	19.1	11.3
039	30.3	35.0	18.6	----
027	32.8	22.6	12.2	16.2
032	22.1	20.5	16.0	21.6
042	25.8	29.6	18.4	16.7
023	26.8	41.8	17.3	14.1
026	21.9	27.9	17.2	17.8
053	19.1	24.6	18.8	15.0
012	10.9	13.9	18.8	46.0
047	18.4	17.6	33.6	48.8
014	18.9	17.4	23.0	40.8
017	19.1	27.2	22.3	66.7
071	30.8	25.2	18.8	35.7
(non smokers)				
046	----	28.0	13.4	23.0
035	24.7	22.0	11.6	16.0
024	19.2	28.0	7.8	19.5
013	24.4	22.4	21.7	32.5
019	26.7	19.9	13.6	26.3
015	23.3	27.3	17.6	24.6
049	19.6	28.6	10.1	11.8
055	22.1	30.3	23.9	24.6
034	26.3	22.2	8.0	24.9
045	26.6	38.1	27.3	13.1
067	56.6	15.1	17.2	24.4
070	30.8	18.1	17.6	23.5

Group 1A	Test			
(smokers)	1	2	3	4
350	17.0	21.6	19.7	7.6
348	12.6	23.7	14.2	10.7
347	16.3	27.4	18.1	18.4
329	14.8	23.7	20.5	14.5
336	13.3	21.1	13.0	----
321	----	----	24.4	19.9
313	25.9	13.7	13.4	14.1
284	20.0	29.5	14.9	12.2
320	22.7	21.6	17.3	15.4
340	17.4	17.9	16.5	11.9
253	40.1	42.1	36.2	20.8
318	28.8	21.1	19.2	9.5
339	12.2	24.2	36.4	8.9
283	25.3	10.2	13.9	12.5
337	33.1	24.9	33.1	32.1
346	20.0	16.1	----	----
314	21.8	22.9	15.9	17.7
315	21.8	17.6	17.9	14.0
349	----	----	15.9	10.3
286	19.2	37.1	17.6	21.3
325	17.3	14.8	17.6	13.3
333	5.8	12.6	4.6	10.0
345	12.2	28.1	17.6	17.3
316	14.7	19.3	21.4	17.3
331	16.6	23.0	15.3	12.7
(non smokers)				
323	14.1	21.1	15.7	14.5
312	----	---	16.5	16.1
334	14.1	28.9	13.4	----
285	17.0	22.1	13.4	13.0
326	20.0	28.4	14.9	16.8
258	16.6	13.7	12.6	7.9
343	19.2	21.5	16.5	16.5
327	32.2	17.6	25.8	38.8
330	22.7	19.5	17.2	12.2
351	13.9	18.5	17.2	15.0
338	10.9	44.9	9.9	12.2
324	7.7	25.4	19.8	13.0
328	20.5	31.7	17.2	24.0
341	9.6	13.7	13.2	7.3
319	10.9	14.1	9.9	8.0

BLOOD - Copper

µg/100 ml whole blood

Group 3	Test			
(smokers)	1	2	3	4
112	74.3	67.2	64.0	54.8
141	153.6	104.0	200.6	131.0
180	145.5	139.9	152.2	113.9
142	83.4	66.3	105.0	74.1
295	68.2	84.7	---	---
221	61.1	62.6	68.9	65.5
187	83.0	75.0	---	---
236	78.0	60.0	---	---
149	59.0	93.0	52.1	60.1
176	77.0	103.0	124.8	101.5
600	136.7	160.1	128.8	88.0
139	126.4	158.9	135.7	108.7
230	135.7	172.8	77.7	78.7
204	61.1	82.4	114.2	51.6
210	110.8	106.7	81.0	70.6
098	144.0	146.2	110.5	115.9
122	109.8	111.4	88.4	62.2
(non smokers)				
111	119.1	109.6	139.0	113.9
311	73.3	51.6	72.5	54.8
133	65.0	93.0	53.2	63.4
203	85.0	68.0	74.9	61.2
297	98.0	76.0	99.1	72.0
080	71.0	80.0	107.2	66.3
161	122.0	125.0	104.2	109.8
177	67.0	77.0	57.0	55.9
110	96.3	112.5	133.7	103.6
224	77.7	107.9	65.9	111.9
129	106.7	[illegible]	114.2	100.1
296	76.6	[illegible]	82.9	66.4
222	93.2	120.6	122.4	99.1
094	124.3	141.5	101.3	101.2

Group 3A	Test			
(smokers)	1	2	3	4
091	54.8	52.3	50.0	51.5
131	62.2	47.5	---	---
227	80.1	46.6	88.3	91.7
245	61.2	43.7	51.8	62.7
206	90.5	78.0	---	---
226	58.9	79.8	71.4	88.9
126	84.3	79.8	88.4	63.0
229	69.8	68.9	112.3	79.9
195	105.1	106.0	99.4	96.7
233	104.2	116.9	95.7	97.5
175	66.2	69.8	82.9	77.3
157	41.7	48.0	95.7	44.6
209	47.5	52.6	44.2	52.1
188	88.8	100.8	85.6	122.7
123	88.8	71.4	81.6	75.0
182	50.1	45.5	67.9	83.9
214	46.6	---	45.2	---
186	86.0	46.4	73.7	88.3
172	76.0	65.1	66.8	82.0
244	85.0	110.6	100.3	83.9
109	93.0	76.7	117.0	80.3
169	92.0	97.3	81.6	---
(non smokers)				
165	62.2	51.3	56.2	63.6
083	112.8	104.6	96.4	111.3
136	101.2	83.7	54.4	60.8
215	63.7	59.0	58.9	---
160	60.1	39.9	---	---
120	101.5	82.5	71.4	101.0
097	48.0	48.9	38.4	50.5
213	58.9	64.3	54.3	98.2
225	46.6	55.3	50.6	52.1
131	93.2	63.4	85.5	70.6
166	61.5	40.2	---	---
125	100.2	100.8	90.4	109.8
170	79.1	---	79.6	79.4
234	59.0	66.9	66.8	67.8
118	81.0	60.7	---	54.4

BLOOD - Lead

µg/100 ml whole blood

Group 2	Test			
(smokers)	1	2	3	4
503	30.6	22.2	29.9	31.5
264	27.1	23.0	17.8	18.9
004	40.3	47.6	38.1	34.2
273	29.8	32.0	27.2	25.2
281	20.1	21.4	18.1	16.2
504	15.8	21.4	19.9	14.4
270	34.1	23.0	41.7	27.0
262	25.4	20.5	20.8	----
266	35.0	36.1	34.4	----
405	39.4	37.8	34.4	36.0
066	54.3	45.2	36.9	----
058	57.0	51.4	45.6	41.4
002	----	----	20.0	40.7
275	26.3	21.4	20.4	23.5
061	34.5	42.9	33.0	43.4
(non smokers)				
279	27.1	23.0	17.8	18.9
003	28.9	27.9	29.0	23.4
001	----	31.2	27.2	19.8
502	21.9	19.7	21.8	19.8
269	27.1	44.4	30.8	29.7
500	24.5	----	18.1	----
402	15.0	21.4	13.4	11.5
404	29.3	19.3	15.7	20.4
006	30.0	36.4	26.7	29.3
005	40.5	43.9	31.4	37.5
065	41.3	66.4	37.7	43.9
276	24.8	32.1	21.2	----
501	24.0	15.0	21.2	23.5
278	21.0	20.4	15.7	18.5
505	19.5	42.9	26.7	18.5
277	21.0	21.4	11.8	14.6
271	22.5	26.8	20.4	30.5

Group 2A	Test			
(smokers)	1	2	3	4
298	26.1	31.7	24.2	30.9
307	19.9	20.4	18.4	19.3
291	17.9	19.7	15.0	17.7
287	17.9	28.2	20.7	23.2
248	13.8	20.4	17.8	13.2
299	17.2	29.6	24.7	26.7
303	16.5	28.2	22.4	14.9
401	17.9	30.4	15.5	24.2
309	16.5	22.4	15.0	14.9
305	16.9	30.4	16.1	22.9
288	----	----	11.5	19.8
292	----	46.4	56.0	29.1
601	----	36.8	20.4	27.7
261	24.0	21.6	80.0	19.2
250	24.0	28.0	18.7	18.0
(non smokers)				
246	21.3	25.4	17.3	17.7
259	9.6	19.0	17.8	20.4
304	11.0	39.2	12.7	9.9
249	16.5	25.6	15.0	19.8
257	13.8	19.2	9.2	14.3
400	14.1	23.2	29.3	19.2
251	12.7	17.6	29.3	14.9
255	21.1	18.4	21.3	14.3
290	----	19.2	24.0	18.6
301	16.9	20.0	8.0	8.5

BLOOD - Lead

µg/100 ml whole blood

Group 3 (smokers)	Test 1	2	3	4
112	19.6	16.2	10.0	22.8
141	16.0	10.1	7.7	14.4
180	14.9	10.8	9.2	17.1
142	20.6	25.2	9.2	15.2
294	17.8	17.3	----	----
295	10.0	12.6	----	----
221	17.8	19.8	10.0	8.0
187	20.6	19.8	----	----
236	14.2	12.7	----	----
149	6.1	10.5	6.2	12.2
176	7.6	14.5	7.7	17.1
600	4.4	11.9	13.8	16.0
139	9.2	11.1	13.1	10.0
230	18.5	16.3	24.6	15.0
204	11.3	16.3	20.3	8.8
210	12.5	7.7	11.5	8.8
098	9.0	9.6	18.0	11.3
122	10.1	8.1	14.7	10.0
(non smokers)				
111	14.9	10.8	8.1	15.2
311	20.0	17.3	8.1	15.2
133	17.8	20.8	10.6	22.0
203	14.2	15.1	7.3	15.2
297	10.5	11.9	9.6	13.3
080	10.9	12.7	13.1	15.2
161	8.7	12.7	13.8	13.3
177	13.5	19.8	22.9	15.2
110	8.3	11.1	6.6	7.5
224	10.9	13.7	16.4	7.5
129	4.8	11.9	13.1	10.5
296	7.6	13.2	11.5	8.0
222	11.3	15.8	8.2	13.8
094	9.8	9.6	14.7	5.0

Group 3A (smokers)	Test 1	2	3	4
091	13.8	14.9	9.7	25.3
131	20.9	28.6	----	----
227	9.4	11.4	7.7	11.7
245	10.5	8.0	8.7	11.7
206	17.1	11.4	----	----
226	12.1	18.9	17.7	---
126	9.4	9.1	14.4	---
229	14.3	9.1	16.3	---
195	13.6	8.4	9.8	12.7
233	16.0	9.8	9.2	15.3
175	13.6	9.8	14.4	19.9
157	17.6	7.0	13.1	30.6
209	14.4	9.1	11.8	11.0
188	13.6	10.5	12.4	19.2
123	16.0	8.4	12.4	14.6
182	16.0	11.9	15.0	21.6
214	5.6	----	6.3	---
186	12.8	9.1	9.2	9.2
172	21.6	16.4	11.2	16.0
244	19.2	11.1	17.0	13.1
109	12.6	7.7	7.3	9.7
169	9.1	10.1	7.8	----
(non smokers)				
165	12.7	13.7	9.2	8.7
083	15.4	12.6	12.1	23.8
136	8.8	8.6	9.2	9.2
215	8.8	8.6	6.7	----
160	11.0	9.7	----	----
120	8.3	10.3	8.7	9.7
097	8.8	12.0	----	12.1
213	5.0	7.7	8.5	18.2
225	4.0	11.9	14.4	25.2
134	17.6	9.8	10.5	17.3
166	17.6	4.9	----	---
125	8.0	18.9	9.8	20.4
170	21.6	11.6	14.4	22.3
234	----	10.6	9.7	7.3
118	9.7	9.7	----	9.2

BLOOD - Manganese

µg/100 ml Blood

Group 1	Test			
(smokers)	1	2	3	4
022	4.3	3.2	1.8	2.9
054	1.8	1.2	1.5	1.2
038	2.4	1.5	1.3	1.3
029	1.2	1.6	1.3	0.7
030	2.5	3.1	2.3	1.9
020	12.7	2.2	1.6	1.7
033	1.4	3.3	1.7	0.9
016	1.4	1.5	1.4	1.1
069	1.7	2.2	---	0.7
036	1.5	1.1	1.2	0.9
040	1.4	1.4	3.0	1.0
008	1.6	1.7	2.6	3.1
039	1.4	1.1	0.9	---
027	1.5	2.2	1.1	1.3
032	2.0	1.6	2.0	1.0
042	1.6	0.8	1.6	1.3
023	1.4	2.7	2.7	2.8
026	1.0	3.4	2.1	1.5
053	---	3.2	3.1	---
012	2.3	3.8	5.1	1.6
047	1.0	1.2	1.9	1.8
014	1.0	1.6	2.8	1.8
017	2.9	1.4	1.8	1.9
071	3.0	2.9	2.3	2.0
(non smokers)				
046	---	3.4	4.0	2.3
035	2.1	1.9	1.2	2.6
024	1.6	1.1	1.4	1.2
013	1.7	2.0	1.5	3.1
019	1.7	2.3	2.1	1.4
015	1.6	1.7	1.4	2.0
049	1.8	2.2	2.6	1.4
055	2.2	1.7	2.8	1.6
034	4.8	3.1	2.0	1.6
045	1.7	1.4	2.5	1.1
067	3.0	1.3	1.9	0.8
070	1.3	1.8	2.4	2.4

Group 1A	Test			
(smokers)	1	2	3	4
350	1.6	3.3	2.8	1.8
348	2.5	0.8	1.4	1.3
347	1.0	2.2	7.9	6.3
329	3.6	2.9	0.9	1.4
336	3.4	0.9	1.1	2.2
321	---	6.4	1.5	2.0
313	2.5	4.5	1.5	3.7
284	9.4	6.4	1.9	4.3
320	2.2	1.9	2.2	1.4
340	4.2	2.2	1.5	2.3
253	2.0	2.6	2.1	2.8
318	2.2	1.3	7.9	3.8
339	2.5	5.8	3.7	3.0
283	1.4	1.4	1.2	2.0
337	3.4	2.4	2.1	3.6
346	2.8	1.8	---	---
314	1.5	3.7	1.2	2.4
315	4.0	1.4	3.5	1.6
349	---	1.1	5.9	1.4
286	7.2	1.4	1.6	1.9
325	3.2	1.5	1.4	1.7
333	3.1	1.0	3.6	2.3
345	1.4	1.0	3.7	1.9
316	1.8	1.8	3.1	2.6
331	5.3	3.4	4.8	2.9
(non smokers)				
323	1.0	2.1	0.5	0.6
312	---	10.8	1.5	1.8
334	10.0	6.4	1.2	---
285	0.8	2.2	1.7	2.0
326	2.2	2.8	0.8	3.7
258	1.8	1.7	4.7	2.5
343	7.2	2.5	2.3	2.9
327	4.9	1.5	4.0	4.8
330	3.3	1.9	1.3	2.0
351	1.8	1.9	1.5	4.1
338	3.1	---	3.0	2.2
324	1.2	2.2	1.9	3.2
328	1.4	1.7	4.8	2.6
341	0.9	6.1	1.9	1.8
319	1.6	2.0	0.8	2.9

BLOOD - Manganese

µg/100 ml Blood

Group 2	Test			
(smokers)	1	2	3	4
503	5.1	2.0	1.5	3.6
264	1.7	1.5	1.3	2.1
004	2.6	2.3	4.4	4.3
273	3.9	2.4	1.7	3.2
281	2.5	3.2	1.9	3.7
504	2.0	--	2.3	1.3
270	2.3	2.7	2.4	2.9
262	1.6	1.8	3.0	---
266	1.1	2.9	2.6	---
405	1.4	2.9	1.7	2.2
066	2.4	1.5	1.9	---
058	2.0	3.5	2.7	1.6
002	---	4.3	1.2	2.8
275	1.8	1.9	1.8	1.5
061	1.6	6.0	3.7	2.7
(non smokers)				
279	2.9	1.5	1.9	---
003	2.1	2.6	1.1	3.3
001	---	3.8	2.1	2.1
502	1.6	1.7	2.4	1.5
269	2.6	2.9	2.0	2.3
500	2.1	---	1.3	---
402	1.9	2.4	1.8	1.9
404	1.6	3.6	1.6	2.4
006	1.2	2.0	1.4	6.3
005	2.0	.9	2.3	2.9
065	1.8	0	3.2	3.3
276	1.4	1.9	2.3	---
501	2.7	2.7	3.1	3.4
278	1.9	1.6	4.3	1.5
505	2.5	3.1	2.0	2.5
277	1.0	2.8	2.2	1.6
271	1.5	1.4	1.4	2.6

Group 2A	Test			
(smokers)	1	2	3	4
298	1.9	2.7	1.1	1.7
307	3.7	3.7	2.1	1.5
291	3.4	2.2	5.3	1.5
287	4.9	2.4	1.5	2.1
248	1.9	2.6	2.1	2.3
299	3.2	2.2	1.8	1.1
303	2.6	2.8	2.4	1.8
401	2.4	2.6	3.1	1.4
309	2.7	1.9	1.4	1.4
305	2.4	1.6	2.0	1.8
288	---	---	2.0	1.7
292	---	1.1	.9	1.3
601	---	1.5	2.1	1.8
261	2.8	1.6	2.2	1.5
250	6.2	1.3	2.3	2.2
(non smokers)				
246	1.8	2.2	.8	1.9
259	2.2	2.2	2.9	2.9
304	2.4	2.2	1.6	1.1
249	2.9	3.9	1.2	2.3
257	1.1	1.3	1.3	1.6
400	2.3	2.6	2.4	2.0
251	2.8	1.5	2.1	1.6
255	2.0	1.7	1.8	1.9
290	---	1.4	1.7	1.8
301	1.7	1.3	1.8	1.0

BLOOD - Manganese

μg/100 ml Blood

Group 3	Test			
(smokers)	1	2	3	4
112	2.3	1.7	3.6	2.0
141	2.8	2.5	2.3	4.0
180	2.9	1.7	2.0	3.0
142	2.9	1.6	3.2	2.9
295	1.1	1.3	---	---
221	1.7	2.3	1.5	1.2
187	1.4	1.3	---	---
236	2.4	1.7	---	---
149	2.4	2.4	1.9	2.3
176	1.6	2.4	4.4	2.2
600	---	1.7	1.6	1.6
139	1.9	2.4	1.7	3.7
230	2.9	2.4	1.9	4.7
204	1.6	1.6	2.0	2.0
210	1.2	1.0	1.4	1.4
098	3.0	1.9	2.8	4.1
122	1.6	2.2	1.3	1.6
(non smokers)				
111	2.1	1.6	1.0	1.4
311	1.5	1.3	1.2	1.2
133	2.1	1.4	3.8	3.0
203	1.8	1.7	1.8	2.0
297	2.1	2.5	2.1	3.0
080	1.5	1.6	1.4	1.9
161	1.5	2.2	1.0	3.3
177	2.5	2.1	1.5	2.5
110	1.2	1.2	1.7	2.0
224	4.0	2.1	1.8	2.7
129	2.6	1.9	1.2	1.9
296	1.6	1.7	2.6	3.1
222	2.1	2.3	1.3	1.8
094	1.5	1.5	1.4	1.6

Group 3A	Test			
(smokers)	1	2	3	4
091	2.4	2.9	1.1	2.1
131	1.4	3.7	---	---
227	3.7	3.4	3.0	2.9
245	1.6	2.5	2.6	2.8
206	1.9	2.4	---	---
226	2.9	1.6	2.0	2.3
126	1.9	1.7	1.0	1.5
229	3.2	2.6	1.9	3.1
195	2.4	3.9	2.2	1.8
233	2.9	2.9	1.4	1.4
175	1.7	3.3	1.8	2.3
157	1.9	2.4	2.1	1.7
209	2.3	1.9	2.5	2.9
188	2.5	2.4	2.3	2.6
123	2.5	3.3	1.2	1.6
182	3.4	2.5	2.6	3.1
214	4.5	1.2	2.0	---
186	2.4	2.3	2.1	2.6
172	2.1	2.5	2. 5	---
244	1.9	2.8	1.4	2.3
109	3.0	2.5	---	1.6
169	3.1	2.1	---	---
(non smokers)				
165	2.1	1.6	1.0	2.3
083	2.0	4.1	2.2	2.4
136	1.5	2.4	1.1	1.2
215	2.1	1.4	1.8	---
160	2.0	2.8	---	---
120	3.9	1.2	3.2	1.2
097	1.2	2.1	1.2	1.0
213	3.3	7.2	1.0	1.6
225	2.9	2.2	1.6	2.2
134	1.6	2.3	2.7	2.6
166	2.6	1.2	---	---
125	3.2	2.9	2.7	3.0
170	4.7	---	1.2	1.7
234	2.1	1.2	2.5	3.1
118	2.7	3.4	---	5.9

PLASMA - Zinc

µg/100 ml Plasma

Group 1	Test			
(smokers)	1	2	3	4
022	310	400	300	360
054	362	360	284	362
038	346	432	300	278
029	342	372	292	384
030	334	350	306	312
020	320	302	292	292
033	398	400	338	356
016	378	492	352	380
069	468	410	---	344
036	374	392	338	254
040	312	396	356	260
008	336	370	346	308
039	308	320	312	---
027	378	380	262	332
032	320	432	320	406
042	344	382	398	326
023	330	540	338	386
026	330	261	288	302
053	402	325	264	362
012	326	296	338	260
047	406	367	324	244
014	336	293	346	362
017	382	341	332	344
071	360	319	364	270
(non smokers)				
046	310	332	292	256
035	298	382	266	306
024	314	416	282	270
013	354	320	288	300
019	374	380	278	412
015	---	400	352	260
049	378	386	350	296
055	398	506	314	338
034	364	292	262	290
045	386	322	360	332
067	340	312	348	282
070	386	328	306	296

Group 1A	Test			
(smokers)	1	2	3	4
350	362	292	218	278
348	370	396	310	382
347	340	354	282	356
329	292	292	280	330
336	314	276	316	316
321	378	328	242	316
313	382	378	280	312
284	362	254	256	304
320	280	324	---	294
340	306	300	196	368
253	376	206	234	242
318	350	280	266	386
339	376	236	266	382
283	366	312	322	346
337	296	296	284	268
346	300	382	---	---
314	310	236	276	290
315	322	268	280	268
349	426	306	284	264
286	320	284	252	322
325	354	314	280	294
333	398	328	350	378
345	256	278	218	348
316	362	264	262	318
331	260	264	298	308
(non smokers)				
323	338	268	296	290
312	286	286	---	260
334	284	290	---	---
285	376	286	276	346
326	322	338	204	290
258	314	314	318	272
343	356	314	298	364
327	384	244	256	334
330	376	268	238	308
351	292	260	274	286
338	346	---	246	334
324	396	298	312	326
328	372	278	288	304
341	352	302	232	268
319	382	308	308	316

PLASMA - Zinc

µg/100 ml Plasma

Group 2 (smokers)	Test 1	2	3	4	Group 2A (smokers)	Test 1	2	3	4
503	349	301	288	426	298	492	321	240	356
264	341	433	324	266	307	282	262	487	385
004	514	359	392	324	291	279	313	261	301
273	300	294	392	--	287	322	306	269	293
281	214	228	336	240	248	358	369	305	367
504	197	290	392	377	299	311	302	334	400
270	184	425	381	337	303	337	229	254	282
262	211	379	374	--	401	442	299	320	257
266	218	332	320	--	309	400	211	236	148
405	327	298	290	318	305	374	258	436	278
066	169	356	312	--	288	--	236	276	326
058	335	298	428	378	292	345	316	330	347
002	--	--	396	318	601	180	294	334	286
275	297	433	378	382	261	242	261	287	265
061	282	193	294	378	250	337	323	261	278
(non smokers)					(non smokers)				
279	288	240	320	350	246	232	358	280	319
003	456	414	284	434	259	326	391	338	286
001	284	209	296	270	304	337	261	276	274
502	206	329	340	327	249	323	316	254	381
269	290	290	356	340	257	297	349	391	378
402	301	278	385	326	400	396	280	240	278
404	169	433	414	333	251	312	378	425	274
006	188	313	305	300	255	290	312	280	290
005	227	247	312	551	290	--	316	298	257
065	197	259	428	285	301	370	225	290	294
276	293	286	370	--					
501	238	182	294	326					
278	360	348	352	326					
505	279	321	341	292					
277	312	240	254	318					
271	331	329	290	296					

PLASMA - Zinc

μg/100 ml Plasma

Group 3		Test		
(smokers)	1	2	3	4
112	221	219	305	256
141	390	172	272	311
180	217	143	171	226
142	241	210	223	286
221	241	210	240	306
187	269	224	--	--
236	315	239	--	--
149	222	283	223	191
176	256	201	204	195
600	252	239	223	286
139	253	250	232	195
230	335	210	309	286
204	324	216	260	337
210	364	335	208	332
098	324	227	230	217
122	200	301	208	318
(non smokers)				
111	221	243	232	151
311	277	214	268	216
133	241	219	203	341
203	322	291	223	306
297	298	196	171	271
080	210	201	250	243
161	214	201	213	248
177	319	294	223	238
110	277	288	232	248
224	315	283	213	338
129	284	250	299	235
296	297	199	234	295
222	333	238	252	281
094	390	233	291	281

Group 3A		Test		
(smokers)	1	2	3	4
091	244	254	212	286
131	231	168	--	--
227	272	281	249	240
245	175	177	221	324
226	228	241	286	274
126	250	178	304	247
229	290	173	328	277
195	165	197	268	290
233	264	216	314	412
175	255	277	231	243
157	201	164	291	316
209	353	244	309	321
188	265	192	314	433
123	265	220	248	244
182	175	352	248	220
214	218	230	296	--
186	196	253	276	267
172	235	220	253	--
244	243	173	191	403
109	188	220	234	267
169	162	220	253	--
(non smokers)				
165	351	141	194	215
083	194	127	217	240
136	198	163	221	236
215	295	186	217	--
160	268	141	--	--
120	226	186	249	202
097	299	--	295	244
213	313	202	226	307
225	384	216	295	334
134	346	253	272	230
166	184	234	--	--
125	316	183	357	267
170	341	211	234	520
234	188	277	195	478
118	132	183	--	286

Trace Elements in Hair

HAIR - Cadmium

µg/g Hair

Group 1	Test			
(smokers)	1	2	3	4
022	.2	.3	0	0
054	.4	.7	.4	.3
038	.1	.7	.2	.2
029	3.9	3.0	2.4	2.9
030	.8	1.0	.7	.6
020	--	1.1	--	1.0
033	.2	.1	0	0
016	1.9	2.0	1.2	2.8
036	8.3	9.1	15.2	12.1
040	.1	.1	0	0
008	.3	.5	0	0
039	.4	.5	.3	.6
027	.8	.9	1.0	.7
032	1.1	1.3	.5	.7
042	2.4	2.2	2.7	1.8
023	--	.3	--	.3
026	.7	.6	.3	.3
053	.2	.3	.1	.1
012	1.2	.8	1.1	.3
047	.1	.3	.2	.2
014	.7	.8	.6	.7
017	.5	.3	.5	.3
071	.2	.5	.5	.4
(non smokers)				
046	.2	.2	0	0
035	4.3	.4	0	.1
024	.5	.5	.3	.1
013	.3	.3	.3	.3
019	.8	.8	.5	.4
015	.2	.4	0	0
049	1.4	1.9	1.0	1.0
055	1.0	.4	.5	.5
034	.3	.7	.4	.4
045	.7	1.2	1.2	1.2
067	.7	1.2	.7	.4
070	0	0	0	0

Group 1A	Test			
(smokers)	1	2	3	4
350	.2	.1	.1	0
348	1.7	1.8	.9	1.2
347	.9	.7	.6	.5
329	.6	.6	.5	.5
336	.5	.3	.5	.4
321	.8	.5	.5	.5
313	.5	.2	.4	.3
284	15.0	13.5	7.8	8.4
320	.4	.9	.5	.4
340	1.3	1.3	1.4	.8
253	1.7	1.8	.1	1.3
318	.2	.2	1.3	0
339	1.1	1.0	.4	1.2
283	.3	.3	.2	.3
337	.1	.1	.1	.1
314	.4	.2	.8	.3
315	.2	.2	.3	.3
349	1.7	3.6	7.0	5.7
286	2.0	2.0	2.4	3.6
325	1.1	1.0	.9	1.0
333	.4	.5	.6	.6
345	--	4.7	--	4.7
316	.2	.3	.3	.3
331	.1	.1	.1	.3
(non smokers)				
323	.6	.7	.6	2.2
312	2.0	2.2	2.1	2.2
334	.8	1.0	1.0	1.1
285	1.1	.5	.5	.4
326	.6	.6	.4	.3
258	.5	.4	.2	.5
343	.3	.2	1.3	.2
327	.3	.2	--	.2
330	0	.1	.1	.1
351	.6	.6	.6	.6
338	.4	.4	.4	.6
324	.7	.7	.6	.6
328	.8	.8	.4	.4
341	.3	.3	.2	[illegible]

HAIR - Cadmium

μg/g Hair

Group 2	Test			
(smokers)	1	2	3	4
503	.1	.4	.2	.3
264	.4	.3	.4	.1
270	.7	.9	1.2	1.1
266	--	--	--	5.4
405	2.0	2.6	1.7	1.1
058	2.8	2.3	3.8	2.0
002	.7	.7	.8	.6
275	.5	.6	.6	.7
061	1.2	0	.6	1.4
(non smokers)				
279	.2	.4	.2	.2
003	--	--	--	2.2
001	1.9	.8	1.5	1.2
502	.3	.4	.4	.2
269	2.1	1.2	1.2	1.5
402	.5	.4	.6	.7
404	.6	.5	.6	.6
065	--	--	--	.3
501	.8	1.1	1.4	1.6
278	.3	.4	.2	.3
505	--	3.1	--	3.0
277	.3	.3	--	.5

Group 2A	Test			
(smokers)	1	2	3	4
298	1.0	8.7	5.0	.3
307	10.1	8.4	5.2	5.4
291	1.9	3.7	1.6	2.1
287	5.9	5.6	6.5	6.1
248	1.0	.9	.9	.9
299	2.9	2.0	2.6	1.9
303	.8	1.0	1.0	.5
401	1.4	.5	.6	.4
309	2.0	2.4	1.9	2.2
305	1.7	--	1.8	1.1
288	5.3	5.5	4.8	5.4
292	.6	1.5	.4	1.1
601	5.1	3.1	1.6	1.5
261	.6	.7	1.1	.8
250	2.9	2.7	3.1	2.9
(non smokers)				
246	.2	.1	.2	.2
259	5.5	--	4.9	2.5
304	1.5	1.4	2.3	1.5
249	.3	.3	.2	.3
257	1.6	1.2	2.0	2.1
400	1.5	.7	.7	.9
251	.2	.2	.4	.2
255	.3	1.2	.1	.1
290	3.4	2.7	2.0	5.6
301	2.2	2.2	1.6	2.5

HAIR - Cadmium

µg/g Hair

Group 3 (smokers)	Test 1	2	3	4
112	.4	.4	.4	.5
141	.7	.6	--	.6
180	1.2	.8	.7	1.6
142	.4	.8	.3	.7
295	--	--	--	.5
236	--	.5	--	--
149	.5	.5	.2	--
600	.9	.4	1.0	.6
139	.1	.1	0	.1
230	.8	.4	.8	.2
204	.3	.2	1.0	.8
210	1.0	.6	.8	.9
098	.7	.7	.6	.7
122	.4	.1	.3	.3
(non smokers)				
111	.3	.2	.4	.3
311	.2	.2	.1	.1
133	.8	1.0	1.1	.9
203	1.7	2.4	1.2	2.0
297	.2	.1	.2	.1
080	1.1	1.3	.8	.9
161	.5	.4	.4	.5
177	.5	.7	.5	.5
110	.7	.8	.6	.4
224	.6	1.0	.6	.6
129	.2	.3	.1	.2
296	.9	.8	.4	.9
222	.3	0	0	.1
094	.2	.1	.4	1.1

Group 3A (smokers)	Test 1	2	3	4
091	.4	.2	.4	.4
131	--	--	--	.5
227	0	0	1.9	1.8
245	.3	.3	.3	.3
226	.7	.6	.6	.8
126	.8	1.1	1.6	.9
229	1.0	.9	.9	1.1
195	1.2	2.1	1.9	1.7
233	.3	.2	.3	.4
175	.3	.6	.6	.4
157	.3	.2	.1	0
209	.5	.4	.4	.3
188	0	.9	0	0
123	0	0	0	.1
182	1.8	.5	.6	1.4
186	.2	.2	.2	.1
172	1.0	.9	1.4	1.1
244	2.9	1.4	1.5	2.3
109	.8	.9	.9	--
(non smokers)				
165	.8	.8	.9	.9
083	1.0	1.2	.9	.7
136	.3	.2	.1	.2
215	.4	.7	.4	.3
160	1.6	.9	.7	.8
120	.5	.2	.5	.3
097	.1	.1	--	--
213	.6	.5	.6	.5
225	.2	.2	.2	.2
134	0	0	0	0
166	--	--	--	.1
125	.2	.1	.2	.2
170	.9	.2	.8	.8
234	1.6	1.5	1.2	.9
118	.1	.7	.2	--

HAIR - Copper

μg/g Hair

Group 2	Test			
(smokers)	1	2	3	4
503	5.0	5.5	3.5	5.0
264	30.2	36.1	40.9	30.5
270	10.7	12.9	15.9	15.2
266	--	--	--	11.6
405	6.5	6.6	5.7	7.2
058	12.5	10.8	14.3	10.2
002	33.3	35.3	38.4	34.0
275	11.6	9.8	10.8	12.3
061	20.2	3.9	7.4	9.0
(non smokers)				
279	7.1	10.0	7.1	7.0
003	--	--	--	10.8
001	9.2	8.6	10.1	10.5
502	5.9	5.8	5.4	6.0
269	13.0	8.3	7.5	9.6
402	16.6	16.1	16.7	18.6
404	9.0	11.5	10.0	10.0
065	--	--	--	13.2
501	7.6	7.6	7.5	8.3
278	11.0	9.8	9.6	10.5
505	--	12.9	--	12.3
277	12.7	13.5	--	15.0

Group 2A	Test			
(smokers)	1	2	3	4
298	12.2	3.8	8.4	5.4
307	15.0	9.6	13.5	13.2
291	10.8	11.7	13.1	11.3
287	14.1	13.3	16.9	16.5
248	11.5	10.0	11.5	10.0
299	22.5	20.6	25.6	20.6
303	8.0	13.2	17.2	9.4
401	17.2	13.6	13.5	12.8
309	14.4	17.5	13.7	13.7
305	17.2	--	18.4	14.1
288	10.2	9.6	7.7	8.8
292	11.8	10.3	9.9	12.0
601	18.8	7.8	9.0	11.0
261	11.0	10.3	11.8	12.1
250	15.0	11.4	11.5	11.5
(non smokers)				
246	11.1	8.5	8.7	8.1
259	25.2	21.9	26.1	15.0
304	32.4	28.7	32.2	30.7
249	24.4	8.9	8.8	9.4
257	9.3	6.5	9.6	9.9
400	19.7	13.1	12.5	15.5
251	41.4	41.9	46.2	36.3
255	9.2	8.7	10.0	10.1
290	10.7	12.5	12.4	10.0
301	11.3	14.6	14.5	12.4

HAIR - Copper

μg/g Hair

Group 1	Test			
(smokers)	1	2	3	4
022	6.8	8.3	9.2	8.2
054	17.7	7.4	16.6	12.2
038	6.5	8.9	17.0	10.4
029	8.7	8.6	7.5	9.0
030	10.5	11.8	12.7	11.5
020	--	13.0	--	13.0
033	6.5	7.6	7.3	7.8
016	13.9	14.9	12.6	28.7
036	19.9	16.9	21.0	19.1
040	10.9	11.2	13.3	10.9
008	7.8	8.2	8.5	7.9
039	19.9	13.9	17.7	12.3
027	11.7	12.4	13.0	11.5
032	12.5	16.8	12.3	12.5
042	9.0	8.1	9.0	7.7
023	--	6.8	--	7.4
026	11.2	11.4	9.3	9.3
053	13.1	11.3	12.5	11.2
012	36.7	13.9	11.3	9.9
047	9.7	10.1	10.6	10.2
014	15.4	21.3	13.5	11.9
017	8.2	7.6	9.0	7.4
071	9.4	10.6	10.9	9.3
(non smokers)				
046	7.0	7.4	8.3	9.2
035	5.9	9.3	9.0	8.4
024	12.3	14.7	13.4	11.8
013	8.4	9.0	7.6	8.0
019	16.1	11.1	12.1	9.5
015	6.8	7.6	7.7	6.9
049	32.2	31.3	21.3	20.5
055	37.8	37.1	34.8	26.2
034	7.5	7.6	7.9	7.4
045	11.7	20.3	20.2	11.2
067	12.9	12.1	13.3	11.5
070	13.0	12.9	12.4	12.9

Group 1A	Test			
(smokers)	1	2	3	4
350	10.2	7.3	8.5	8.0
348	10.0	8.9	8.7	8.3
347	9.0	6.3	9.3	8.9
329	26.0	29.8	21.1	23.5
336	9.6	8.1	9.7	9.5
321	12.0	7.6	9.1	11.8
313	14.6	7.6	12.1	14.6
284	13.6	11.7	11.2	12.1
320	24.4	38.7	26.6	40.1
340	21.5	21.0	22.4	12.1
253	13.7	11.3	7.7	18.9
318	7.0	24.6	26.8	7.1
339	29.1	24.6	21.1	27.4
283	8.5	10.0	8.6	9.8
337	8.4	7.6	7.6	7.9
314	8.7	8.0	8.5	7.5
315	13.0	16.4	28.4	25.0
349	11.6	10.9	10.2	10.1
286	8.7	11.3	8.7	10.0
325	13.4	12.5	14.6	13.0
333	12.7	13.2	11.9	11.4
345	--	13.5	--	12.4
316	18.9	20.1	15.9	14.3
331	10.3	6.9	6.8	6.0
(non smokers)				
323	11.8	13.4	12.0	6.7
312	12.0	13.6	13.0	13.6
334	42.7	35.2	38.0	38.7
285	9.3	8.1	9.3	8.7
326	14.1	11.4	12.8	13.7
258	20.0	19.2	28.5	20.7
343	29.9	28.4	26.8	27.3
327	7.2	8.7	--	7.1
330	6.7	6.9	6.2	6.0
351	7.9	8.6	7.7	7.4
338	9.0	9.3	8.6	8.8
324	19.8	19.7	18.0	19.3
328	10.7	11.0	9.7	9.4
341	7.7	8.0	7.5	7.[illegible]
310	16.3	17.0	14.4	[illegible]

HAIR - Copper

μg/g Hair

Group 3	Test			
(smokers)	1	2	3	4
112	13.1	12.9	13.1	11.3
141	32.4	31.4	--	33.7
180	45.7	44.5	32.7	59.6
142	54.2	62.7	51.1	58.6
295	--	--	--	40.0
236	--	--	--	125.1
149	18.8	17.9	18.9	--
600	21.3	20.2	23.2	36.6
139	14.5	14.4	13.0	12.7
230	17.6	14.4	19.1	11.9
204	5.7	5.9	5.0	5.1
210	23.0	21.5	20.1	53.4
098	54.8	44.0	56.3	47.7
122	51.4	62.6	63.3	53.6
(non smokers)				
111	13.1	15.2	14.5	15.5
311	13.4	14.2	13.0	14.2
133	18.9	21.7	22.4	23.1
203	35.8	44.5	22.2	43.2
297	8.5	8.9	8.7	8.9
080	24.1	26.5	28.4	30.7
161	19.1	18.4	17.7	18.6
177	32.1	34.4	30.6	32.7
110	101.5	120.7	92.0	113.5
224	36.9	34.0	70.5	52.1
129	11.0	9.9	11.4	11.3
296	66.2	66.2	40.6	63.3
222	10.4	10.0	17.4	11.4
094	32.5	29.8	32.1	19.8

Group 3A	Test			
(smokers)	1	2	3	4
091	19.5	18.7	19.3	19.5
131	--	--	--	27.4
227	20.2	20.2	13.1	13.6
245	15.1	14.5	12.1	10.4
226	21.1	20.6	20.6	19.1
126	31.2	37.4	27.0	28.5
229	36.7	35.8	37.3	33.9
195	12.6	13.9	14.7	10.2
233	26.6	35.9	33.1	40.5
175	91.4	136.4	111.4	152.3
157	8.9	8.1	7.9	7.4
209	57.8	41.5	42.2	32.5
188	11.2	14.6	11.7	10.7
123	9.3	11.1	10.1	7.0
182	27.6	11.1	10.7	17.2
186	25.6	20.2	22.8	20.5
172	45.8	35.9	39.3	39.3
244	170.7	97.3	115.9	118.5
109	13.6	13.4	14.2	--
(non smokers)				
165	23.1	22.7	18.2	17.8
083	9.7	12.4	8.0	6.2
136	14.2	13.4	13.9	15.2
215	29.3	28.6	27.0	34.1
160	70.8	40.6	28.9	39.6
120	16.1	11.4	17.3	15.4
097	21.0	20.5	--	--
213	20.0	17.5	16.7	17.4
225	12.1	10.9	10.3	11.0
134	32.8	12.0	11.9	9.8
166	--	--	--	26.9
125	23.2	24.4	21.2	24.1
170	26.3	25.0	21.6	22.7
234	16.0	13.3	11.7	13.5
118	7.4	8.4	11.2	--

HAIR - Lead

µg/g Hair

Group 1 (smokers)	Test 1	2	3	4
022	8.8	8.4	8.7	6.6
054	19.1	23.0	19.6	18.4
038	13.2	20.7	50.7	35.6
029	37.3	31.3	27.8	33.3
050	26.8	21.0	21.1	19.4
020	35.7	32.0	--	--
033	2.5	2.6	2.1	3.7
016	56.0	24.6	18.6	30.8
036	76.4	89.4	197.5	41.4
040	68.9	4.4	3.8	4.8
008	85.5	14.0	6.0	7.4
039	79.4	22.4	9.0	12.2
027	54.4	22.0	18.1	12.6
032	77.0	41.7	7.9	9.6
042	376.9	34.7	24.6	14.6
023	4.1	3.9	--	--
026	10.6	22.8	6.2	4.6
053	9.1	12.0	11.4	11.5
012	20.5	34.8	15.6	8.5
047	2.4	6.0	3.5	2.4
014	19.1	37.2	16.7	14.4
017	19.9	16.4	17.2	12.0
071	4.3	13.6	5.8	6.7
(non smokers)				
046	3.0	3.1	21.9	4.0
035	9.4	13.0	7.9	8.8
024	11.1	14.5	16.5	8.8
013	5.5	8.1	6.9	4.9
019	17.7	17.0	16.9	12.6
015	17.4	27.0	9.8	9.0
049	54.8	31.4	26.4	26.6
055	46.8	35.7	24.4	17.4
034	6.1	9.6	5.4	5.4
045	43.3	7.1	11.0	11.2
067	23.8	52.8	16.4	10.4
070	2.4	1.6	2.8	1.8

Group 1A (smokers)	Test 1	2	3	4
350	2.0	0.2	1.7	0.2
348	77.3	57.3	32.5	42.2
347	20.5	20.5	12.9	11.2
329	26.8	28.9	24.5	[illegible]
336	14.6	17.5	20.8	17.2
321	11.4	8.4	18.0	9.0
313	18.9	8.0	9.1	11.0
284	48.6	0.2	22.9	35.4
320	13.8	14.4	12.6	14.0
340	15.8	16.2	16.7	7.6
253	34.3	34.9	1.2	27.4
318	2.5	5.0	20.3	1.2
339	28.9	18.3	3.1	25.6
283	1.4	0.2	0.6	1.0
337	4.1	2.0	2.8	1.8
314	7.7	5.7	3.1	5.3
315	0.8	1.0	5.0	3.9
349	27.9	23.8	25.3	23.7
286	6.5	7.3	9.3	11.0
325	4.5	3.3	6.5	4.3
333	1.1	0.8	1.3	2.8
345	76.6	62.2	--	--
316	1.1	1.0	1.3	4.7
331	4.3	2.2	1.1	1.6
(non smokers)				
323	9.7	10.1	10.3	4.4
312	59.3	65.5	59.3	65.0
334	16.9	22.5	21.7	28.5
285	10.6	6.0	5.8	4.4
326	8.5	5.8	6.0	6.8
258	4.3	3.4	5.3	4.2
343	8.9	6.7	16.5	5.8
327	3.3	2.8	3.7	2.0
330	2.6	1.2	1.9	1.4
351	10.6	10.3	10.0	9.4
324	5.6	1.6	4.1	1.8
328	14.2	14.9	10.5	10.2
341	0.5	0.8	5.8	0
319	0.9	0.4	1.1	1.8

HAIR - Lead

µg/g Hair

Group 2		Test		
(smokers	1	2	3	4
503	5.5	10.9	8.8	8.9
264	18.2	32.6	43.6	18.3
270	23.0	88.0	98.4	48.9
266	191.8	--	--	--
405	106.2	95.9	102.5	56.8
058	105.2	156.0	198.3	74.9
002	31.7	19.8	23.0	28.3
275	16.3	23.2	19.0	23.7
061	119.2	84.1	104.6	111.7
(non smokers)				
279	1.0	2.0	3.1	1.5
003	124.1	--	--	--
001	18.9	14.4	14.5	11.8
502	12.2	17.3	19.3	22.4
269	114.2	99.0	102.3	111.5
402	10.4	21.8	12.4	12.9
404	31.9	22.4	20.0	22.6
065	26.7	--	--	--
501	48.8	64.7	66.4	69.8
278	10.6	9.4	7.6	9.2
505	74.3	71.4	--	--
277	16.8	17.4	20.4	17.8

Group 2A		Test		
(smokers)	1	2	3	4
298	13.5	11.6	9.5	12.4
307	43.0	43.7	20.4	21.4
291	94.3	8.5	5.4	17.7
287	51.2	47.5	38.9	37.5
248	6.6	6.4	5.4	4.8
299	21.7	17.7	23.6	21.0
303	24.5	26.6	11.6	18.6
401	14.2	13.2	8.9	4.6
309	81.9	55.7	67.7	47.4
305	63.3	136.5	27.8	64.1
288	10.3	8.3	7.7	9.3
292	16.9	11.3	15.1	20.4
601	44.3	57.1	51.5	22.7
261	12.8	8.5	18.4	10.3
250	18.5	16.5	19.5	10.9
(non smokers)				
246	4.5	2.2	2.8	2.8
259	60.9	79.6	105.6	71.2
304	41.1	45.8	41.7	47.7
249	8.8	9.6	2.2	5.0
257	18.7	19.8	22.6	24.2
400	32.9	12.7	10.7	22.6
251	9.2	9.4	5.0	8.1
255	4.7	2.9	5.0	4.2
290	104.7	92.4	115.5	119.3
301	59.3	13.4	25.6	56.7

HAIR - Lead

μg/g Hair

Group 3	Test			
(smokers)	1	2	3	4
112	4.7	8.1	4.3	4.7
141	44.0	85.8	4.3	17.8
180	20.9	30.1	6.1	18.2
142	4.6	2.4	5.0	2.6
295	8.2	--	--	--
236	--	2.4	--	--
149	4.6	4.3	2.7	2.4
600	12.3	18.0	6.3	8.7
139	1.0	0.6	1.0	0.4
230	8.2	4.4	3.0	3.6
204	17.8	16.1	12.9	14.3
210	2.2	3.8	4.7	4.9
098	5.7	5.1	3.5	6.7
122	4.7	2.2	2.2	2.5
(non smokers)				
111	8.6	4.6	6.3	4.1
311	1.8	2.4	0.9	2.4
133	1.2	1.8	2.4	1.1
203	11.3	4.4	3.3	6.0
297	2.9	1.6	2.8	2.0
080	17.1	3.7	6.4	5.5
161	8.9	6.0	4.8	4.5
177	4.1	2.4	2.0	2.6
110	2.8	1.2	0.7	1.7
224	9.8	5.5	3.0	5.4
129	6.8	10.1	5.4	4.5
296	8.9	4.6	0.5	3.8
222	39.0	17.1	6.6	26.4
094	4.8	2.8	1.8	2.4

Group 3A	Test			
(smokers)	1	2	3	4
091	3.1	1.4	1.8	2.7
131	4.0	--	--	--
227	0	0	4.5	4.2
245	6.8	5.3	6.2	6.7
226	3.3	5.0	1.7	3.3
126	5.5	2.4	2.6	2.7
229	5.5	7.4	4.7	5.8
195	2.0	5.9	5.1	2.4
233	0.3	1.8	2.0	1.2
175	5.3	3.8	2.8	6.3
157	1.8	0.6	0.6	0.9
209	5.5	1.6	2.6	2.2
188	0	2.2	0	0
123	2.0	1.6	1.1	3.6
182	2.7	4.6	5.4	2.6
186	11.6	7.9	6.0	6.6
172	2.8	8.7	4.9	6.6
244	4.1	4.2	3.6	4.2
109	5.2	6.5	5.8	--
(non smokers)				
165	5.5	6.1	10.6	10.8
083	19.3	20.0	17.8	40.4
136	10.7	9.7	13.7	10.2
215	3.6	4.8	6.4	7.3
160	12.8	16.2	14.7	5.4
120	11.9	9.5	16.1	11.4
097	7.6	6.9	--	--
213	1.2	1.8	1.7	1.2
225	1.6	3.2	3.1	4.6
134	3.9	3.6	2.3	2.2
166	0.8	--	--	--
125	9.5	2.8	9.4	15.3
170	1.4	3.6	1.1	1.3
234	11.2	15.8	10.6	11.4
118	1.0	19.1	0.8	--

HAIR - Manganese

µg/g hair

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	.25	.13	.22	.26
054	.07	.47	.32	.44
038	0	.41	.24	.20
029	.09	.29	.18	.13
030	.12	.40	.28	.22
020	.18	.13	---	---
033	.10	.07	0	.06
016	.66	.71	.48	.72
036	2.35	1.68	2.24	2.41
040	.12	.18	.08	.19
008	0	.30	.18	.26
039	.81	.44	1.45	.36
027	.21	.22	.43	.26
032	.12	.10	.24	.22
042	.37	0	.39	.21
023	0	0	---	---
026	.16	.24	.22	.09
053	.29	.18	.17	.09
012	1.03	.69	.54	.37
047	.14	.20	.24	.11
014	.32	.28	.59	.50
017	.14	.20	.29	.21
071	.36	.36	.46	.39
(non smokers)				
046	.04	.38	.08	.09
035	0	.31	.14	.17
024	.12	.18	.10	.07
013	0	.02	.73	.04
019	.04	.31	.18	.19
015	0	.18	.05	.13
049	.33	.51	.24	.26
055	.29	.18	.37	.21
034	.04	.04	.17	.06
045	3.04	.61	.63	.51
067	.19	.20	.32	.15
070	.04	.04	.07	.04

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	.16	.06	.14	.12
348	.40	.28	.25	.30
347	1.29	1.29	1.19	1.07
329	.64	.35	.42	.08
336	.20	.12	.17	1.12
321	.36	.13	.27	.34
313	.22	.02	.17	.38
284	1.34	1.73	.79	.85
320	.24	.35	.23	.32
340	.14	.14	.16	.16
253	.42	.37	.12	.38
318	.21	.12	.54	.12
339	.34	.24	.29	.46
283	.04	.04	.02	0
337	.13	.08	.15	.18
314	.17	.22	.27	.34
315	.13	.20	.44	.60
349	.28	.39	.59	.70
286	.06	0	.04	0
325	.18	.10	.08	.08
333	.15	.08	.15	.07
345	.10	.12	---	---
316	.22	.10	.08	.16
331	.06	.06	0	.10
(non smokers)				
323	.08	0	.06	.02
312	.42	.44	.38	.46
334	.16	.15	.24	.37
285	.16	.12	.12	.19
326	1.44	1.30	1.04	1.12
258	.40	.20	.40	.27
343	.14	.08	.54	.21
327	.22	.12	.31	.27
330	.06	.04	.04	.16
351	.18	.25	.17	.10
338	.15	.02	0	.18
324	.11	.06	.08	.02
328	.24	.21	.10	.14
341	.14	0	.06	0
319	.09	.06	.15	.06

HAIR - Manganese

µg/g hair

Group 2	Test			
(smokers)	1	2	3	4
503	.16	.27	.11	.17
264	.44	.70	1.22	.14
270	1.7	1.37	5.84	4.48
266	2.40	---	---	---
405	.82	.84	.56	.49
058	2.69	2.74	2.39	3.00
002	.40	.42	.31	.28
275	.42	.35	.36	---
061	1.34	1.44	1.22	---
(non smokers)				
279	.12	.18	.06	.06
003	1.84	---	---	---
001	.33	.18	.33	.17
502	.20	.22	.19	.32
269	7.7	.67	.15	0
402	.34	.34	.29	.22
404	.63	.52	.37	.46
065	.59	---	---	---
501	.38	.30	.43	---
278	.50	.40	.48	---
505	1.14	1.10	---	---
277	.23	.23	---	---

Group 2A	Test			
(smokers)	1	2	3	4
298	.54	.24	.41	1.28
307	0	0	.89	.87
291	.52	1.06	1.06	1.09
287	0	.15	.51	.28
248	.03	0	0	.12
299	2.66	3.71	2.36	2.94
303	.24	.99	.79	.75
401	1.44	.69	.95	.72
309	.86	.92	1.03	1.12
305	1.05	---	1.30	1.46
288	.12	0	.22	.15
292	0	.60	.89	.71
601	.28	1.46	.98	.18
261	0	.09	.24	.16
250	.36	.32	.44	.19
(non smokers)				
246	.09	.17	.03	.16
259	.95	---	1.59	1.71
304	.45	0	0	1.10
249	0	0	.12	0
257	.06	.28	.25	.41
400	.76	.43	.67	1.19
251	.30	.22	.22	.06
255	0	0	.13	0
290	.81	1.44	1.15	1.49
301	.88	.62	.47	1.38

HAIR - Manganese

μg/g hair

Group 3 (smokers)	Test			
	1	2	3	4
112	.26	.17	.31	.22
141	.26	.31	.38	.23
180	.42	.23	.38	.41
142	.86	1.15	.69	1.98
295	.21	---	---	---
236	.18	---	---	---
149	.28	.23	.38	---
600	.48	.18	.38	.41
139	.14	.14	.15	.24
230	.38	.18	.36	.18
204	.70	.56	.57	.68
210	.52	.40	.63	.14
098	.34	.12	.16	.10
122	.22	.06	.14	.11

(non smokers)

111	.12	.04	.18	.12
311	.20	.27	.23	.18
133	.58	.16	.16	.18
203	.22	.12	.22	.12
297	.82	.72	.82	.72
080	.22	.23	.22	.27
161	.58	.56	.91	.82
177	.34	.35	.27	.29
110	.64	.76	.60	.80
224	.60	.08	.07	.19
129	.14	.14	.18	.22
296	.08	.08	.12	.10
222	.15	.06	.10	.13
094	.13	.07	.19	.72

Group 3A (smokers)	Test			
	1	2	3	4
091	.25	.14	.45	.27
227	.02	.10	.18	.07
245	.02	.06	.08	.10
226	.19	.20	.12	.13
126	.56	.58	.63	.67
229	.71	.74	.67	.75
195	1.63	.40	.84	.63
233	.33	.19	.26	.27
175	.22	.16	.41	.18
157	0	.10	.24	.15
209	1.77	1.44	1.71	1.27
188	0	.50	.14	0
123	0	0	.03	.02
182	1.10	.20	.32	.94
186	.02	.10	.07	0
172	.51	.18	.40	.74
244	.30	.04	.16	.20
109	.53	.29	.51	---

(non smokers)

165	.20	.28	.28	.19
083	.11	.04	.24	.09
136	.20	.14	.06	.14
215	.17	.12	.15	.14
160	1.02	.70	.73	.28
120	.13	.08	.10	.09
097	.39	.42	---	---
213	.85	.44	.63	.54
225	12.09	10.38	8.28	10.37
134	.14	.16	.16	.16
166	.04	---	---	---
125	.24	.26	.24	.53
170	.36	.42	.30	.34
234	.60	.35	.40	.36
118	.10	.50	.40	---

HAIR - Zinc

μg/g Hair

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	141.3	163.0	164.4	246.9
054	161.2	148.8	148.5	162.2
038	128.3	142.6	300.5	137.8
029	325.2	115.6	122.7	152.1
030	194.1	167.8	179.2	180.5
020	116.0	116.0	---	---
033	135.8	127.8	143.3	149.9
016	146.0	152.0	146.9	156.0
036	201.7	141.5	156.9	159.1
040	177.0	164.3	173.0	186.6
008	181.7	177.5	180.2	179.0
039	355.3	341.0	---	340.7
027	184.8	167.9	185.7	169.5
032	153.3	285.9	171.6	156.6
042	206.7	169.1	212.6	172.9
023	157.3	157.3	----	----
026	172.6	166.3	186.6	175.9
053	141.8	159.8	156.3	153.5
012	267.3	137.2	145.5	135.6
047	157.2	156.8	170.1	159.8
014	166.5	158.2	151.7	146.9
017	149.5	161.4	172.7	167.9
071	203.4	198.5	220.6	182.8
(non smokers)				
046	133.6	148.8	156.6	162.2
035	125.8	128.2	142.1	206.7
024	125.8	102.9	101.7	309.0
013	160.5	167.1	151.0	151.0
049	153.7	158.3	127.7	125.4
055	223.6	196.1	212.5	161.4
034	149.5	153.3	180.8	168.1
045	126.4	132.0	159.1	143.8
067	133.7	132.4	146.9	134.0
070	195.4	316.2	192.3	165.3

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	147.0	128.5	147.4	148.6
348	196.6	196.9	173.3	157.8
347	206.2	193.3	195.4	200.1
329	153.3	135.0	151.8	146.4
336	156.7	395.0	140.6	161.1
321	136.7	121.4	134.9	151.0
313	101.7	158.3	108.4	105.7
284	138.3	168.3	133.2	136.9
320	168.3	248.3	183.1	190.3
340	117.8	120.8	120.1	116.0
253	165.0	376.6	125.5	188.7
318	142.1	127.0	184.6	131.8
339	188.7	169.5	228.5	183.8
283	171.9	171.6	173.5	178.2
337	150.4	168.2	176.7	168.6
314	166.2	160.0	165.0	158.3
315	172.8	174.3	240.0	216.7
349	108.1	138.8	135.0	123.3
286	132.5	127.5	148.3	138.3
325	192.3	182.4	195.0	183.8
333	164.6	164.8	165.0	188.1
345	143.5	138.5	----	----
316	214.7	228.2	201.7	198.3
331	145.5	147.9	148.3	180.0
(non smokers)				
323	162.2	168.3	165.3	124.1
312	152.5	151.7	144.6	149.5
334	220.2	200.4	211.2	226.1
285	278.7	155.0	145.7	163.0
326	190.0	178.3	164.3	161.3
258	246.7	220.4	213.5	235.9
343	210.0	349.9	189.6	219.6
327	162.1	321.2	167.4	163.0
330	154.9	145.3	163.3	166.7
351	154.1	162.6	160.3	171.7
338	114.6	109.7	126.9	126.8
324	236.4	221.1	227.3	215.0
328	146.9	134.9	150.0	141.7
341	155.4	148.3	161.5	150.0
319	212.0	213.7	206.7	200.0

HAIR - Zinc

µg/g Hair

Group 2	Test			
(smokers)	1	2	3	4
503	144.5	140.9	148.4	149.3
264	169.9	172.2	159.8	161.8
270	124.7	141.3	139.7	141.8
266	248.8	--	--	--
405	142.3	181.5	133.0	112.8
058	140.8	157.8	135.7	151.4
002	178.5	181.5	171.4	168.4
275	218.2	155.7	150.1	256.6
061	187.1	269.5	122.7	99.0

(non smokers)				
279	151.6	159.6	151.2	146.2
003	124.4	--	--	--
001	197.1	193.1	200.2	186.5
502	126.6	119.3	117.6	124.3
269	964.6	524.9	199.1	155.5
402	142.8	146.2	146.2	166.7
404	136.4	139.5	166.3	131.6
065	144.9	--	--	--
501	108.4	95.4	86.2	95.8
278	173.2	161.4	163.0	175.9
505	139.8	136.7	--	--
277	186.3	210.7	223.7	--

Group 2A	Test			
(smokers)	1	2	3	4
298	1084.8	324.0	166.5	271.0
307	169.3	245.8	162.9	155.7
291	168.4	161.7	162.1	181.6
287	100.4	88.2	106.5	106.5
248	125.5	129.0	123.9	130.3
299	240.4	251.5	249.5	252.7
303	143.6	171.6	170.7	158.9
401	193.4	179.7	187.5	176.4
309	92.2	128.1	96.4	87.8
305	128.7	--	147.6	118.9
288	156.7	161.7	157.3	165.3
292	234.9	144.2	141.3	147.7
601	156.4	141.5	135.3	161.7
261	117.6	120.9	105.5	135.1
250	152.6	101.3	103.3	109.6

(non smokers)				
246	228.7	200.9	191.0	190.7
259	179.8	185.9	157.5	145.2
304	159.5	162.5	156.6	160.0
249	141.4	150.3	144.6	146.2
257	122.4	91.5	116.0	116.0
400	98.5	132.3	131.9	133.5
251	201.8	196.0	200.2	205.0
255	154.1	158.4	155.7	189.1
290	106.6	97.7	89.7	98.0
301	92.2	444.6	151.1	169.3

HAIR - Zinc

µg/g Hair

Group 3 (smokers)	Test 1	2	3	4
112	162.7	197.9	162.4	168.0
141	198.7	192.3	216.0	152.3
180	239.4	252.7	230.2	268.9
142	235.1	272.1	479.1	240.6
295	225.3	---	---	---
236	187.5	---	---	---
149	222.5	229.6	228.6	---
600	241.0	237.9	214.5	220.0
139	161.2	165.3	170.7	161.2
230	153.3	163.7	152.9	163.4
204	187.8	187.5	195.5	197.6
210	222.3	419.9	452.1	242.1
098	203.4	244.7	222.3	279.5
122	222.1	222.5	201.8	220.9

(non smokers)				
111	159.6	165.3	153.0	160.4
311	148.9	157.7	99.9	142.6
133	82.9	316.2	321.7	331.2
203	159.6	174.8	149.8	167.8
297	184.6	184.3	181.3	196.1
080	178.7	230.7	187.6	176.5
161	170.3	165.4	184.5	181.2
177	201.9	212.9	205.0	212.4
110	358.5	367.1	315.4	382.1
224	264.5	223.7	198.7	231.1
129	357.2	381.4	337.5	168.4
296	225.3	222.5	257.0	213.9
222	227.2	210.3	242.3	196.1
094	186.4	189.9	189.7	441.5

Group 3A (smokers)	Test 1	2	3	4
091	206.4	215.9	223.8	198.0
131	326.8	---	---	---
227	251.4	314.1	187.5	227.0
245	195.4	204.1	185.7	189.4
226	334.7	347.9	313.6	345.9
126	387.6	367.4	324.1	382.5
229	247.0	272.1	255.8	121.8
195	73.7	95.8	110.4	95.2
233	137.1	165.4	156.9	166.1
175	212.7	335.4	327.6	362.4
157	229.0	228.9	208.5	202.9
209	368.3	321.2	355.7	327.6
188	153.7	182.8	164.7	173.9
123	160.8	175.7	173.5	158.5
182	187.4	172.2	160.9	173.9
186	178.5	173.9	180.5	169.0
172	298.1	294.0	285.5	303.8
244	544.5	321.2	394.2	410.0
109	244.7	244.7	240.0	----

(non smokers)				
165	175.7	204.1	175.8	166.9
083	361.9	468.6	317.1	395.3
136	262.6	314.1	332.9	316.6
215	484.0	528.7	502.8	417.6
160	283.1	274.6	284.8	287.3
120	174.5	142.0	185.7	197.7
097	169.8	182.8	----	----
213	156.9	163.3	164.7	166.6
225	265.6	280.8	253.7	248.7
134	179.4	207.6	189.2	190.4
166	187.7	---	---	---
125	166.6	184.6	166.4	172.0
170	145.7	189.9	152.4	153.7
234	384.0	403.8	937.0	368.2
118	128.7	143.7	131.5	---

Trace Elements in Urine

URINE - Cadmium

µg/liter of urine

Group 1	Test			
(smokers)	1	2	3	4
022	1.3	1.5	1.7	0.8
054	2.6	1.2	0.7	1.3
038	1.4	1.3	1.2	1.2
029	4.5	0.6	1.1	0.9
030	1.1	0.9	0.6	0.9
020	3.1	0.9	1.2	2.5
033	3.3	1.5	0.6	0.5
016	2.1	1.4	1.5	0.6
069	2.5	1.5	--	--
036	3.1	1.2	0.8	0.9
040	2.4	0.9	1.8	0.6
008	2.3	0.4	1.3	0.8
039	3.1	0.8	0.9	2.0
027	4.5	1.8	1.1	0.9
032	2.7	1.5	0.9	0.6
042	9.6	2.1	1.0	1.8
023	1.7	0.8	0.6	0.9
026	1.7	1.0	1.0	0.4
053	1.6	0.6	1.7	1.2
012	0.9	1.3	0.3	1.3
047	1.4	1.7	0.5	1.4
014	1.6	1.2	0.9	1.2
017	1.9	1.9	1.3	1.2
071	2.7	1.4	0.9	0.6
(non smokers)				
046	2.6	0.7	0.7	1.3
035	2.0	1.7	0.5	0.5
024	2.5	1.5	0.8	1.2
013	2.5	0.7	0.8	1.1
019	2.2	1.4	0.7	1.2
015	3.6	1.1	1.0	0.3
049	2.7	1.4	2.3	0.9
055	1.9	0.8	0.9	0.7
034	1.9	2.3	1.2	0.5
045	1.2	0.6	1.6	0.1
067	1.9	1.5	2.9	1.1
070	1.3	0.6	0.9	0.6

Group 1A	Test			
(smokers)	1	2	3	4
350	0.4	1.0	0.1	0.6
348	0.4	1.0	0.9	0.6
347	0.2	0.2	0.2	0.4
329	0.3	0.2	0.2	0.6
336	0.6	0.2	0.8	0.7
321	0.6	0.5	0.4	2.2
313	0.5	1.0	0.2	0.3
284	0.3	0.9	0.7	1.8
320	--	0.2	0.2	2.2
340	0.3	0.2	0.7	0.7
253	0.3	--	0.2	0.5
318	2.0	1.1	0.4	0.9
339	0.9	0.7	0.6	1.3
283	0.6	0.4	0.8	1.4
337	1.1	0.4	1.0	0.8
346	0.2	0.2	--	--
314	0.6	0.3	0.7	1.8
315	0.4	0.3	1.0	0.5
349	0.6	0.9	0.3	0.7
286	1.1	0.2	0.3	0.9
325	1.9	0.5	0.6	0.8
333	1.6	0.6	0.7	0.6
345	1.2	0.2	0.3	1.1
316	0.8	0.3	0.2	1.4
331	0.7	0.2	0.3	0.2
352	0.6	0.4	--	--
(non smokers)				
323	1.5	0.4	0.5	1.1
312	0.5	0.4	0.9	1.1
334	0.6	0.3	0.2	--
285	0.2	--	0.2	0.4
326	0.8	0.4	0.3	0.6
258	0.4	0.5	0.3	0.8
343	0.7	0.4	0.5	1.7
327	0.6	0.5	0.4	0.3
330	1.5	0.6	0.3	1.5
351	0.6	1.0	0.7	0.9
338	0.2	--	0.8	0.3
324	0.3	0.2	0.2	0.4
328	0.4	0.3	0.2	0.5
341	1.1	0.1	0.3	0.9
319	1.0	0.3	0.2	0.6

URINE - Cadmium

µg/liter of urine

Group 2		Test			Group 2A		Test		
(smokers)	1	2	3	4	(smokers)	1	2	3	4
503	2.6	0.6	0.7	0.4	298	0.4	0.3	0.5	0.3
264	0.7	1.4	1.0	0.6	307	0.3	0.3	0.4	0.6
004	2.3	0.8	0.7	0.3	291	0.2	0.3	0.5	0.5
273	0.2	0.3	--	--	287	0.8	0.9	0.4	0.7
281	0.7	2.3	0.7	0.2	248	0.3	0.3	0.5	0.4
504	1.1	0.5	0.7	0.4	299	0.3	0.7	0.4	0.3
270	1.5	1.1	1.1	1.4	303	0.5	0.5	0.2	0.3
262	0.7	0.5	1.0	--	401	0.7	1.0	0.9	0.6
266	--	1.0	0.9	0.6	309	0.2	0.4	0.4	0.4
405	0.3	--	0.3	0.8	305	0.4	0.4	0.4	0.3
066	--	2.4	1.9	--	288	1.0	0.9	0.5	0.8
058	--	0.5	0.8	0.7	292	0.8	0.2	0.5	0.4
002	0.2	0.5	1.0	0.6	601	1.4	0.7	0.4	0.7
275	1.2	0.4	0.7	0.3	261	0.5	0.3	0.8	0.6
061	1.3	0.5	1.1	0.7	250	0.3	0.3	0.4	--
(non smokers)					(non smokers)				
279	4.5	0.4	0.6	0.7	246	0.8	0.7	0.2	0.6
003	0.3	1.6	1.2	0.3	259	0.4	0.3	0.3	--
001	0.6	1.0	0.5	0.4	304	0.6	1.0	0.5	0.6
502	0.5	0.4	1.2	0.4	249	0.4	0.3	0.4	0.3
269	1.7	0.5	0.6	1.0	257	0.3	0.2	0.3	0.3
402	1.1	1.3	0.6	0.4	400	0.4	1.1	0.5	0.4
404	0.4	0.7	0.3	0.6	251	0.4	0.8	0.4	0.6
006	0.9	2.8	0.4	0.5	255	0.6	0.3	0.6	0.5
005	0.5	1.7	0.5	--	290	0.6	0.6	0.6	0.4
065	1.3	0.4	0.5	0.5	301	0.6	0.7	0.6	0.5
276	0.8	0.5	1.6	--					
501	0.5	0.8	1.0	0.3					
278	1.3	0.5	0.8	0.3					
505	1.9	0.6	1.1	0.8					
277	0.4	0.7	0.9	0.6					
271	0.2	1.6	0.7	0.4					

URINE - Cadmium

µg/liter of urine

Group 3	Test				Group 3A	Test			
(smokers)	1	2	3	4	(smokers)	1	2	3	4
112	0.6	0.8	0.3	0.6	091	0.4	0.8	0.6	1.8
141	0.3	0.5	0.3	1.3	131	0.7	0.7	--	--
180	0.5	0.7	0.6	0.6	227	0.7	0.6	0.6	0.6
142	0.5	6.1	1.2	0.9	245	0.5	0.3	1.0	1.0
221	0.4	1.3	0.4	--	226	0.2	0.4	0.7	0.4
187	0.4	1.3	--	--	1	0.6	0.6	0.2	0.8
236	0.4	0.3	--	--	229	0.7	0.8	0.3	0.2
149	0.1	0.3	0.3	0.4	195	0.5	0.3	0.4	0.4
176	0.1	0.5	0.5	0.2	233	0.6	0.5	0.3	0.4
600	0.2	0.4	0.7	0.7	175	0.4	0.4	0.5	0.3
139	0.2	0.3	0.5	2.5	157	0.4	0.8	0.3	0.8
230	0.2	1.2	1.8	0.9	209	1.0	--	0.6	0.8
204	0.2	0.5	0.6	1.3	188	0.4	0.6	0.4	0.7
210	0.4	0.3	0.6	0.6	123	0.4	0.7	0.2	0.2
098	0.3	0.3	0.3	0.9	182	0.9	2.3	--	0.4
122	0.1	0.2	0.4	0.5	214	0.7	0.9	--	--
					186	1.1	1.2	1.8	0.3
					172	--	1.8	0.4	--
					244	0.7	1.6	0.8	1.3
(non smokers)					(non smokers)				
111	0.6	1.9	0.5	1.0	165	0.4	0.2	0.5	0.7
311	0.1	1.6	0.6	0.3	083	0.7	0.5	0.5	0.7
133	0.3	0.6	0.7	--	136	0.2	0.3	0.2	0.4
203	0.2	0.2	0.5	--	215	0.4	0.6	0.2	--
297	0.2	--	0.4	0.4	160	0.7	1.8	--	--
080	0.3	0.4	0.4	0.3	120	0.3	0.8	0.6	0.3
161	0.3	0.2	--	0.7	097	0.5	0.7	0.5	--
177	0.5	--	0.4	1.2	213	0.2	0.9	0.3	0.3
110	0.1	0.7	0.4	0.3	225	0.3	0.7	0.4	0.6
224	0.2	0.4	0.3	1.0	134	0.3	0.4	0.3	0.2
129	0.1	0.3	0.6	1.2	166	0.3	0.2	--	--
296	0.4	0.5	0.4	0.7	125	0.8	0.4	0.1	0.3
222	0.2	0.4	0.7	0.6	170	--	1.2	0.2	0.6
094	0.3	0.4	0.3	0.6	234	1.9	0.9	0.6	0.5

URINE - Copper

µg/liter of urine

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	5.4	10.1	9.5	5.2
054	12.0	5.4	11.0	6.6
038	16.9	4.5	8.0	16.9
029	13.9	2.8	8.2	4.4
030	8.6	4.0	3.1	17.4
020	11.5	12.5	16.3	8.8
033	12.1	3.7	5.9	7.7
016	17.9	9.2	17.1	11.6
069	5.5	4.2	-	-
036	9.6	11.7	8.2	12.0
040	10.5	4.7	16.8	11.0
008	10.6	14.5	9.5	4.1
039	7.2	8.0	11.0	27.6
027	6.7	10.1	8.4	4.3
032	5.9	7.1	25.9	13.3
042	7.8	7.5	2.5	10.2
023	6.7	7.5	3.3	2.5
026	4.2	4.7	10.0	1.6
053	5.2	1.5	11.7	3.9
012	3.9	7.8	1.9	9.1
047	2.5	19.0	3.3	10.5
014	3.6	5.7	1.6	9.9
017	4.9	12.3	24.1	1.6
071	25.0	23.3	0.1	12.0
(non smokers)				
046	9.9	3.0	17.9	4.1
035	10.2	2.0	5.1	1.6
024	9.9	10.9	8.6	8.0
013	19.2	6.7	19.4	6.1
019	11.8	4.2	8.3	7.9
015	16.2	5.0	13.7	7.5
049	9.3	11.7	11.4	10.4
055	4.7	6.1	6.9	8.1
034	10.2	3.0	1.6	5.3
045	2.3	7.7	10.4	2.8
067	6.9	14.5	9.3	7.4
070	7.9	4.8	6.4	9.5

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	1.3	10.6	3.3	5.5
348	10.0	6.6	2.9	5.3
347	1.1	2.7	3.3	9.2
329	8.4	3.5	7.0	7.8
336	8.0	13.9	11.8	14.5
321	2.9	6.5	12.9	3.8
313	1.6	1.8	2.0	0.9
284	7.4	13.2	9.7	10.4
320	9.3	2.8	3.5	11.9
340	7.2	14.3	8.1	1.6
253	17.5	-	1.7	2.1
318	2.4	2.6	1.9	3.7
339	4.2	3.7	5.4	6.8
283	4.8	3.0	4.4	8.5
337	15.2	6.1	6.1	8.2
346	6.8	1.9	-	-
314	4.8	1.7	3.6	8.0
315	10.7	14.8	5.1	8.5
349	6.6	1.7	3.4	3.5
286	9.1	3.4	2.1	20.4
325	12.5	7.3	12.0	6.4
333	4.4	7.1	19.2	9.1
345	8.2	20.2	22.6	6.2
316	12.7	9.2	4.2	10.5
331	7.8	2.0	16.1	1.8
(non smokers)				
323	10.1	19.6	11.8	25.3
312	10.0	8.9	17.3	11.0
334	9.9	11.2	5.5	-
285	10.7	-	3.5	5.4
326	3.0	-	2.6	1.1
258	7.1	9.4	2.2	4.2
343	6.9	5.5	4.2	8.5
327	4.0	3.5	7.5	3.1
330	2.5	14.1	2.4	11.6
351	14.5	18.0	8.9	14.2
338	6.1	-	5.1	2.1
324	6.5	5.8	8.2	11.1
328	12.4	10.4	9.2	9.1
341	9.3	2.1	2.0	14.1
319	9.7	7.3	5.1	9.0

URINE - Copper

µg/liter of urine

Group 2	Test 1	Test 2	Test 3	Test 4
(smokers)	1	2	3	4
503	-	6.9	8.5	7.6
264	2.3	3.0	2.1	8.3
004	17.4	18.1	8.4	11.9
273	5.5	2.3	-	-
281	8.5	5.8	1.4	3.9
504	1.2	24.6	1.0	1.1
270	14.5	10.1	12.1	10.4
262	7.3	9.3	3.5	-
266	-	7.3	2.6	-
405	14.3	-	2.5	15.0
066	8.0	2.3	15.1	-
058	-	11.7	10.1	2.8
002	14.5	-2.4	1.9	1.7
275	9.2	2.4	2.2	1.4
061	8.6	6.9	6.6	1.7
(non smokers)				
279	3.7	3.0	1.1	1.5
003	3.2	8.3	6.0	4.4
001	8.9	11.5	9.8	11.7
502	13.4	4.1	13.4	5.5
269	15.6	5.0	6.9	14.4
402	2.1	4.2	2.5	2.0
404	9.8	4.2	1.4	7.6
006	10.7	11.7	3.2	7.1
005	3.9	7.8	1.7	-
065	1.9	1.8	1.9	6.0
276	3.7	1.9	2.1	-
501	14.5	16.6	9.5	6.2
278	3.7	3.2	9.1	1.1
505	16.5	19.9	16.0	14.4
277	5.9	7.5	7.8	1.6
271	9.0	49.6	4.3	2.6

Group 2A	Test 1	Test 2	Test 3	Test 4
(smokers)	1	2	3	4
298	1.8	1.4	8.2	12.4
307	2.2	2.2	4.8	6.8
291	2.3	0.7	10.6	15.0
287	3.3	1.4	8.8	5.7
248	1.9	3.2	5.7	2.6
299	5.2	6.7	13.9	30.2
303	6.4	8.7	14.2	8.6
401	4.0	13.3	12.5	11.7
309	6.9	12.4	8.5	18.8
305	9.8	19.0	9.1	12.0
288	2.5	24.8	14.4	17.4
292	4.9	4.6	8.7	3.3
601	1.4	6.4	9.4	15.6
261	9.0	5.9	18.7	8.5
250	0.9	15.9	9.8	-
(non smokers)				
246	2.7	13.3	6.3	7.0
259	6.3	3.7	4.1	-
304	7.2	5.9	8.3	10.6
249	6.3	15.7	19.3	15.4
257	8.0	9.8	8.4	8.1
400	1.6	5.6	6.7	14.1
251	5.3	8.4	4.7	5.3
255	8.1	3.2	4.9	6.1
290	2.8	9.2	9.1	9.7
301	23.5	18.1	14.4	6.5

URINE - Copper

µg/liter of urine

Group 3	Test			
(smokers)	1	2	3	4
112	12.8	10.5	16.0	33.6
141	9.6	4.3	24.1	45.3
180	17.5	15.8	19.2	-
142	7.3	13.0	35.3	35.1
221	4.8	3.4	19.8	37.2
187	13.0	12.2	-	-
236	7.3	17.0	-	-
149	5.3	25.4	8.4	4.9
176	3.4	12.0	15.9	8.0
600	29.0	6.0	6.3	11.2
139	8.3	7.8	17.5	9.2
230	3.0	4.1	20.9	5.0
204	11.0	24.8	15.8	21.7
210	13.3	14.3	12.9	6.5
098	4.0	24.3	15.1	14.9
122	9.7	8.8	11.0	35.7

(non smokers)

111	13.1	10.3	12.3	-
311	8.3	8.1	10.9	5.1
133	6.5	16.7	9.6	40.3
203	8.9	10.2	11.1	-
297	11.4	-	12.5	4.5
080	35.7	12.8	13.3	15.3
161	13.5	9.0	-	9.7
177	7.2	-	17.6	12.9
110	14.0	18.1	9.9	10.2
224	11.6	13.6	6.0	35.4
129	6.2	3.9	5.3	6.0
296	11.3	14.5	11.7	23.1
222	2.0	14.1	10.8	16.1
094	6.0	7.4	4.8	6.6

Group 3A	Test			
(smokers)	1	2	3	4
091	7.9	6.3	2.9	3.5
131	3.5	6.7	-	-
227	7.6	8.4	17.0	6.3
245	21.1	19.9	17.4	21.7
226	5.0	3.0	8.4	4.0
126	12.4	8.2	4.2	13.2
229	19.8	26.0	7.5	29.9
195	5.0	11.0	19.1	17.0
233	3.6	6.0	24.8	32.2
175	5.0	7.2	10.7	11.6
157	6.8	11.9	8.9	13.7
209	15.6	-	33.9	14.9
188	5.8	29.7	8.9	27.1
123	9.9	5.0	9.8	40.0
182	8.6	25.0	-	10.8
214	7.7	14.7	-	-
186	7.8	5.0	11.0	5.5
172	11.1	28.8	8.9	-
244	9.5	7.4	16.1	20.1
109	11.5	16.4	17.0	12.8
169	6.9	7.2	11.6	-

(non smokers)

165	6.2	9.3	11.2	7.4
083	7.9	12.8	13.0	9.6
136	6.1	12.1	7.8	8.6
215	5.9	8.4	12.0	-
160	10.3	11.3	-	-
120	6.1	7.5	14.2	9.7
097	7.2	10.8	15.4	-
213	6.2	7.0	16.8	15.3
225	17.1	9.9	13.9	18.0
134	9.4	11.9	38.4	7.7
166	6.9	8.5	-	-
125	18.3	8.4	17.7	18.3
170	-	24.2	7.1	11.2
234	19.5	15.1	11.4	26.3
118	6.1	6.7	-	13.7

URINE - Lead

µg/liter of urine

Group 1	Test			
(smokers)	1	2	3	4
022	18.5	40.0	42.1	14.5
054	41.1	16.7	33.0	9.7
038	48.2	26.7	25.0	8.1
029	63.0	85.4	21.6	0.0
030	51.9	80.8	17.1	8.1
020	92.6	46.2	13.7	0.0
033	44.5	53.9	34.1	6.5
016	81.5	42.3	28.4	0.0
069	14.8	92.3	---	---
036	32.0	53.9	15.9	14.5
040	28.0	3.9	26.2	6.5
008	12.0	27.7	23.5	4.5
039	48.0	40.1	29.8	47.0
027	88.0	38.9	18.5	1.5
032	32.0	7.7	23.5	18.2
042	16.0	0.0	7.4	9.1
023	48.0	0.0	9.9	10.6
026	72.0	53.3	40.8	0.0
053	36.0	0.0	11.1	7.6
012	12.0	0.0	7.4	0.0
047	0.0	36.4	11.1	9.1
014	20.0	37.7	9.9	4.6
017	12.0	24.7	24.7	9.1
071	40.0	39.0	19.8	1.5
(non smokers)				
046	41.1	46.7	21.6	0.0
035	62.9	29.9	19.3	0.0
024	44.5	36.7	17.1	1.6
013	41.1	46.7	50.0	9.7
019	63.0	46.2	22.8	6.5
015	51.9	57.7	13.7	24.2
049	24.0	12.3	23.5	1.5
055	48.0	7.7	13.6	12.1
034	24.0	0.0	0.0	12.1
045	24.0	6.1	18.5	1.5
067	24.0	37.7	8.7	0.0
070	8.0	5.2	17.3	0.0

Group 1A	Test			
(smokers)	1	2	3	4
350	0.0	0.0	19.2	21.6
348	18.6	0.0	11.5	8.3
347	0.0	76.6	---	38.3
329	20.9	0.0	44.9	24.9
336	45.3	0.0	51.3	44.9
321	2.7	3.3	25.6	19.9
313	0.0	0.0	2.6	3.3
284	13.3	36.6	38.5	46.6
320	11.9	0.0	14.1	28.3
340	13.3	46.6	29.5	4.9
253	85.3	---	1.3	28.3
318	12.2	0.0	18.2	14.9
339	21.9	23.8	22.7	20.9
283	9.8	0.0	30.7	8.0
337	109.7	23.8	36.8	9.7
346	29.2	0.0	---	---
314	14.6	0.0	21.6	6.5
315	37.5	28.5	21.6	6.5
349	46.8	0.0	26.1	0.0
286	9.4	4.7	0.0	16.1
325	12.5	70.3	15.8	0.0
333	0.0	45.3	28.9	1.6
345	25.0	26.6	3.9	---
316	34.4	43.8	0.0	---
331	---	26.6	6.6	0.0
(non smokers)				
323	0.0	23.3	66.7	31.7
312	56.9	0.0	51.3	43.3
334	26.6	3.3	30.8	---
285	28.9	---	21.8	48.3
326	19.9	---	19.2	8.3
258	0.0	0.0	15.9	3.2
343	12.2	4.7	12.5	12.9
327	21.9	0.0	31.8	8.0
330	7.3	33.3	0.0	3.2
351	39.0	19.0	26.1	32.3
338	0.0	---	35.2	1.6
324	0.0	18.7	15.8	19.4
328	25.0	70.3	36.8	22.6
341	12.5	31.3	14.5	19.4
319	0.0	64.1	14.5	12.9

URINE - Lead

µg/liter of urine

Group 2	Test			
(smokers)	1	2	3	4
503	29.7	53.0	64.5	30.3
264	8.1	3.0	8.6	3.0
004	5.4	59.1	52.7	51.5
273	0.0	4.5	---	---
281	2.7	31.8	9.7	33.3
504	0.0	13.6	4.3	0.0
270	9.5	53.0	51.6	60.6
262	0.0	48.5	20.4	---
266	----	24.2	16.1	21.2
405	0.0	---	12.9	52.5
066	0.0	1.5	49.4	---
058	---	52.9	106.0	49.1
002	2.9	15.3	12.0	32.4
275	0.0	19.9	16.9	25.9
061	23.5	65.8	56.6	37.9
(non smokers)				
279	6.8	4.5	1.1	10.1
003	13.5	48.5	37.6	50.5
001	2.7	83.3	35.5	90.9
502	1.3	45.4	52.7	25.3
269	41.9	37.9	67.7	52.5
402	11.7	12.9	16.8	17.6
404	17.6	18.8	15.6	24.9
006	41.1	68.2	19.2	32.4
005	38.2	88.2	36.1	---
065	5.8	0.0	0.0	29.6
276	97.1	7.0	24.1	---
501	2.9	47.1	22.9	34.2
278	0.0	21.1	16.9	0.9
505	5.8	51.7	28.9	52.7
277	0.0	88.2	18.0	13.8
271	0.0	78.8	15.7	42.6

Group 2A	Test			
(smokers)	1	2	3	4
298	27.9	10.0	1.6	10.5
307	4.9	15.0	32.3	15.8
291	21.3	0.0	46.7	33.3
287	0.0	52.5	0.0	24.6
248	13.1	30.0	37.1	0.0
299	32.8	1.3	1.6	0.0
303	54.1	39.9	17.7	43.1
401	26.9	34.7	33.9	62.7
309	20.5	19.9	20.9	60.1
305	46.2	37.3	33.9	44.4
288	62.8	49.3	24.1	63.9
292	43.6	19.9	49.0	20.9
601	0.0	9.3	58.8	54.8
261	32.1	0.0	47.1	41.8
250	0.0	26.7	17.6	---
(non smokers)				
246	96.7	50.0	14.5	24.6
259	98.4	30.0	11.3	---
304	32.1	38.7	14.5	26.1
249	32.1	22.7	17.7	20.9
257	20.5	17.3	8.0	20.9
400	7.7	18.6	5.9	43.1
251	25.6	19.9	21.6	32.6
255	16.7	23.9	29.4	45.7
290	46.2	31.9	11.7	40.5
301	48.8	38.7	11.7	31.3

URINE - Lead

μg/l of urine

Group 3 (smokers)	Test 1	Test 2	Test 3	Test 4
112	49.3	73.6	32.7	38.3
141	33.3	5.2	39.9	66.6
180	51.9	66.6	56.3	--
142	7.9	17.5	25.4	64.9
221	23.9	8.7	83.8	9.9
187	43.9	54.3	--	--
236	21.3	43.8	--	--
149	13.3	36.8	9.6	8.3
176	13.3	61.4	58.0	11.6
600	71.9	10.8	9.6	149.9
139	25.7	19.9	66.1	19.5
230	10.0	49.9	24.1	21.7
204	7.1	28.3	46.7	60.8
210	22.8	24.9	69.3	2.1
098	0.0	83.3	20.9	41.3
122	20.0	33.3	35.4	10.8
(non smokers)				
111	42.7	36.8	10.9	--
311	53.3	21.0	36.3	16.6
133	30.7	47.3	51.6	61.6
203	21.3	57.8	0.0	--
297	53.3	--	9.6	13.3
080	63.9	47.3	24.1	21.6
161	47.9	37.8	--	46.6
177	29.3	--	61.2	58.3
110	15.9	29.7	20.9	39.1
224	18.6	19.9	17.7	36.9
129	12.8	11.6	90.3	8.6
296	24.2	36.6	85.4	21.7
222	0.0	26.6	69.3	0.0
094	18.5	19.9	33.8	60.8

Group 3A (smokers)	Test 1	Test 2	Test 3	Test 4
091	17.8	15.5	0.0	0.0
131	5.3	20.6	--	--
227	31.4	16.3	28.5	25.7
245	41.0	22.4	73.8	142.4
226	0.0	9.4	0.0	0.0
126	8.3	9.4	--	15.8
229	38.8	13.7	29.2	43.9
195	5.5	2.2	49.9	21.9
233	5.5	8.8	6.0	1.2
175	0.9	0.0	31.7	2.4
157	4.6	9.9	48.7	42.6
209	34.2	--	57.3	14.6
188	14.8	23.3	21.9	[illegible]
123	0.0	0.0	7.3	5.9
182	84.7	37.9	--	37.3
214	23.8	5.7	--	--
186	6.6	0.0	12.1	14.9
172	17.1	9.1	30.4	--
244	5.7	0.0	25.6	32.8
109	15.2	3.4	37.8	20.8
169	35.2	0.0	53.6	--
(non smokers)				
165	14.2	13.7	11.9	31.8
083	1.7	15.5	28.5	13.6
136	21.4	9.4	38.0	31.8
215	8.9	15.5	69.0	--
160	10.7	25.8	---	--
120	0.0	13.7	28.0	--
097	66.6	22.4	64.6	--
213	47.2	19.8	51.2	31.7
225	30.5	17.7	21.9	25.3
134	3.7	7.7	26.8	0.0
166	15.2	0.0	--	--
125	21.9	2.2	43.9	28.3
170	--	35.5	12.1	31.3
234	53.3	4.5	57.3	56.7
118	15.2	0.0	--	14.9

URINE - Manganese

μg/liter of urine

Group 1 (smokers)	Test 1	Test 2	Test 3	Test 4
022	3.3	4.4	2.9	25.1
054	3.2	2.8	11.2	7.8
038	3.0	3.4	3.6	11.0
029	6.3	2.1	6.3	6.1
030	8.5	4.2	3.9	11.6
020	3.1	2.1	4.8	12.4
033	2.5	3.3	5.6	23.8
016	2.4	3.4	4.3	6.1
069	3.9	3.1	----	----
036	3.8	8.4	1.4	12.2
040	13.3	5.5	9.0	10.1
008	1.6	10.1	2.5	13.6
039	5.4	8.1	3.9	18.5
027	6.6	5.0	2.3	6.5
032	4.8	15.6	5.3	10.2
042	3.0	3.1	9.2	11.0
023	6.4	6.1	4.1	7.4
026	3.4	9.3	7.9	2.8
053	7.3	4.6	1.4	5.9
012	2.5	6.2	9.0	12.1
047	4.5	6.0	4.6	6.1
014	3.0	8.7	8.3	5.3
017	14.1	5.8	5.6	16.2
071	5.1	13.0	2.0	13.2

(non smokers)

046	2.9	4.3	4.2	5.3
035	3.1	3.2	6.9	18.6
024	5.2	2.8	1.4	9.1
013	7.8	3.8	3.0	8.0
019	4.4	11.1	2.5	20.7
015	4.9	7.5	3.9	6.3
049	2.2	14.2	3.1	11.6
055	5.6	9.4	4.8	7.2
034	3.1	3.6	2.3	8.5
045	6.4	7.2	1.9	4.8
067	4.3	6.4	2.8	8.6
070	9.1	6.2	4.1	9.6

Group 1A (smokers)	Test 1	Test 2	Test 3	Test 4
350	9.8	7.2	4.8	1.3
348	4.2	12.0	2.9	16.9
347	9.1	6.0	2.7	4.2
329	7.9	22.4	3.5	2.2
336	9.8	8.9	2.6	7.2
321	47.4	8.1	1.1	2.6
313	8.0	3.4	0.5	4.3
284	19.1	21.5	1.7	7.4
320	6.1	5.8	2.4	4.9
340	5.4	10.3	2.8	3.5
253	8.9	----	1.9	4.9
318	10.7	15.9	1.9	3.7
339	4.0	13.0	2.4	10.2
283	9.1	13.4	1.8	8.5
337	10.2	2.4	7.3	3.6
346	7.2	5.2	----	----
314	24.2	7.4	0.9	14.4
315	8.0	7.6	1.6	6.9
349	4.1	13.2	3.8	9.3
286	15.6	7.5	3.5	4.2
325	8.0	10.6	2.9	3.6
333	8.8	5.8	1.5	4.3
345	22.3	6.2	1.7	1.3
316	6.2	13.0	0.3	8.9
331	19.1	4.5	10.6	3.6

(non smokers)

323	5.6	7.1	1.9	2.7
312	8.5	11.1	3.4	4.0
334	10.0	15.5	7.8	----
285	10.0	----	5.6	3.1
326	2.2	----	3.3	2.7
258	12.8	6.2	1.9	6.0
343	13.1	7.9	8.9	2.5
327	6.4	8.4	3.5	2.1
330	12.4	4.4	2.7	1.2
351	9.1	16.0	2.7	6.1
338	7.1	----	7.2	3.4
324	6.4	14.2	2.3	4.8
328	86.2	7.7	2.3	5.1
341	9.3	35.9	0.6	5.0
319	11.3	3.3	2.5	11.2

URINE - Manganese

µg/liter of urine

Group 2 (smokers)	Test 1	2	3	4
503	2.3	5.4	25.3	11.3
264	4.6	4.6	1.2	1.9
004	4.3	19.9	47.6	2.5
273	9.5	0.2	----	----
281	6.9	2.3	6.5	3.3
504	5.1	1.1	2.4	4.4
270	7.6	6.6	2.0	3.2
262	8.6	9.3	1.3	----
266	----	4.6	2.6	2.6
405	9.8	----	1.5	3.5
066	4.3	5.9	2.5	----
058	----	2.2	1.7	2.7
002	1.5	1.2	3.2	5.2
275	2.4	3.7	5.1	4.6
061	4.7	2.2	1.5	1.5

Group 2A (smokers)	Test 1	2	3	4
298	4.8	1.5	12.6	8.5
307	5.4	12.2	13.2	4.9
291	2.9	1.5	18.1	9.2
287	2.7	2.2	4.8	4.5
248	4.1	2.1	34.4	6.1
29[illegible]	5.3	2.7	8.2	5.0
303	3.1	11.0	8.2	21.7
401	4.3	3.2	17.3	13.3
309	13.2	7.7	12.7	9.0
305	1.6	13.7	31.3	17.5
288	4.7	39.8	10.3	7.1
292	2.7	7.3	11.6	12.6
261	26.4	16.8	5.8	21.2
250	6.1	10.6	13.1	----
601	5.2	4.4	5.3	3.2

(non smokers)

Group 2 (non smokers)	Test 1	2	3	4
279	12.7	3.4	2.7	4.1
003	5.7	3.2	3.4	3.1
001	2.5	4.2	3.5	3.6
502	7.5	4.4	1.5	12.7
269	3.8	6.1	6.6	9.3
402	2.0	3.0	11.0	4.6
404	11.9	2.4	2.3	2.0
006	4.2	2.0	2.6	5.6
005	9.4	2.0	3.2	----
065	2.4	4.2	0.4	23.7
276	6.7	2.8	4.3	----
501	5.0	8.4	2.0	3.3
278	2.5	2.0	5.4	1.5
505	6.2	8.4	4.1	17.1
277	8.5	2.3	4.5	2.6
271	2.5	3.8	8.8	6.8

(non smokers)

Group 2A (non smokers)	Test 1	2	3	4
246	2.5	1.4	12.4	10.5
259	2.7	7.1	11.5	----
304	3.5	1.9	7.2	11.2
249	1.3	9.0	6.5	5.6
257	2.1	5.4	11.5	7.2
400	4.5	6.6	10.9	7.5
251	6.7	32.3	14.0	12.9
255	2.2	7.5	65.0	42.4
290	4.5	9.3	6.8	13.3
301	2.5	15.8	7.4	15.2

URINE - Manganese

µg/liter of urine

Group 3 (smokers)	Test 1	2	3	4
112	19.2	30.4	5.9	4.6
141	14.2	5.3	6.8	4.0
180	27.5	5.9	9.8	----
142	12.1	2.0	2.8	10.8
221	14.9	3.8	4.5	8.5
187	8.6	2.5	----	----
236	8.6	14.9	----	----
149	2.0	14.9	5.9	3.6
176	47.7	6.8	7.4	7.8
600	18.8	8.7	6.6	8.6
139	13.5	8.2	9.9	89.1
230	8.5	11.8	5.0	11.4
204	10.3	14.7	8.8	39.3
210	9.3	12.6	10.3	5.2
098	6.8	8.2	26.9	3.7
122	13.5	3.5	7.9	4.4
(non smokers)				
111	19.5	9.9	10.2	----
311	6.6	23.1	6.5	8.7
133	10.6	12.9	21.1	58.5
203	5.8	12.9	4.9	----
297	8.2	----	10.4	44.8
080	10.0	2.9	18.4	6.7
161	20.4	2.3	----	10.9
177	16.5	----	2.6	6.9
110	10.4	7.0	5.0	21.1
224	45.0	3.7	4.6	13.4
129	4.0	12.0	4.7	4.8
296	11.5	10.7	6.5	35.8
222	5.1	6.5	14.7	6.6
094	12.1	4.0	9.3	7.3

Group 3A (smokers)	Test 1	2	3	4
091	52.9	1.0	5.7	7.0
131	9.7	9.1	----	----
227	6.7	2.4	9.9	8.6
245	7.0	1.9	6.0	7.7
226	12.2	2.6	4.5	3.1
126	4.0	3.3	6.7	3.6
229	5.1	5.7	3.5	4.4
195	6.1	5.2	6.5	8.8
233	10.7	2.2	3.5	2.9
175	15.0	2.3	3.5	3.0
157	6.6	3.4	5.7	5.2
209	24.0	----	4.5	6.1
188	19.1	3.7	28.6	3.4
123	15.9	3.7	51.9	4.4
182	2.0	1.2	----	4.4
214	3.3	1.5	----	----
186	5.2	2.4	5.4	5.5
172	11.9	2.8	4.5	----
244	2.5	6.6	6.9	3.8
(non smokers)				
165	20.9	----	3.7	6.2
083	17.4	0.9	3.9	2.7
136	4.2	1.7	10.7	4.2
215	69.6	7.4	2.9	----
160	6.6	2.4	----	----
120	21.6	2.6	6.6	9.5
097	11.6	4.0	28.8	----
213	7.0	6.5	12.7	3.1
225	3.6	2.6	7.4	2.7
134	3.1	4.1	2.8	1.8
166	3.0	3.5	----	----
125	24.1	3.3	7.8	2.5
170	----	3.8	9.9	4.1
234	68.8	2.3	15.3	4.1

URINE - Zinc

µg/liter of urine

Group 1 (smokers)	Test 1	 2	 3	 4
022	153.	170.	466.	218.
054	158.	133.	437.	235.
038	124.	90.	239.	410.
029	110.	173.	288.	335.
030	113.	144.	260.	427.
020	230.	193.	592.	680.
033	241.	210.	221.	559.
016	269.	144.	423.	241.
069	263.	462.	---	---
036	115.	119.	104.	298.
040	67.	360.	346.	261.
008	249.	377.	638.	593.
039	168.	351.	749.	255.
027	334.	363.	558.	627.
032	252.	336.	491.	235.
042	188.	102.	189.	221.
023	308.	207.	568.	403.
026	84.	105.	437.	153.
053	53.	21.	279.	261.
012	216.	237.	354.	122.
047	87.	126.	419.	153.
014	126.	180.	354.	479.
017	182.	404.	1085.	667.
071	631.	463.	518.	421.
(non smokers)				
046	153.	116.	592.	252.
035	198.	82.	334.	129.
024	90.	90.	184.	381.
013	173.	278.	502.	476.
019	167.	210.	423.	461.
015	308.	261.	460.	680.
049	188.	263.	620.	114.
055	297.	180.	577.	426.
034	109.	148.	239.	--
045	160.	153.	453.	224.
067	224.	503.	964.	482.
070	252.	175.	552.	278.

Group 1A (smokers)	Test 1	 2	 3	 4
350	215.	358.	224.	106.
348	393.	606.	272.	465.
347	77.	744.	227.	575.
329	261.	141.	164.	267.
336	358.	342.	977.	695.
321	143.	169.	164.	204.
313	235.	405.	164.	730.
284	126.	138.	346.	634.
320	163.	694.	312.	344.
340	189.	505.	249.	587.
253	175.	---	45.	135.
318	88.	612.	167.	67.
339	143.	237.	269.	408.
283	71.	232.	82.	115.
337	458.	603.	229.	357.
346	264.	277.	---	---
314	198.	214.	171.	381.
315	194.	201.	203.	186.
349	445.	201.	707.	634.
286	224.	432.	145.	412.
325	316.	128.	191.	169.
333	397.	356.	272.	499.
345	150.	171.	29.	534.
316	185.	204.	78.	219.
331	217.	115.	168.	514.
(non smokers)				
323	341.	556.	269.	383.
312	530.	339.	542.	361.
334	146.	295.	153.	---
285	430.	--	181.	767.
326	131.	113.	90.	175.
258	111.	395.	184.	196.
343	278.	138.	173.	608.
327	352.	50.	490.	710.
330	243.	132.	92.	244.
351	366.	564.	287.	647.
338	475.	---	510.	254.
324	224.	198.	307.	186.
328	465.	613.	330	352.
341	399.	389.	205.	646.
319	226.	412.	156.	129.

URINE - Zinc

µg/liter of urine

Group 2	Test			
(smokers)	1	2	3	4
503	461.	492.	496.	505.
264	473.	167.	361.	110.
004	618.	1032.	1361.	480.
273	395.	320.	---	---
281	563.	527.	103.	154.
504	202.	493.	---	129.
270	705.	543.	491.	537.
262	793.	1245.	334.	---
266	---	550.	587.	393.
405	711.	222.	---	303.
066	637.	257.	---	---
058	570.	458.	642.	449.
002	189.	182.	192.	199
275	582.	652.	551.	228.
061	508.	684.	540.	290.
(non smokers)				
279	444.	319.	408.	189.
003	457.	876.	746.	522.
001	775.	505.	317.	445.
502	632.	300.	767.	471.
269	1250.	596.	318.	423.
402	260.	540.	295.	162.
404	450.	400.	248.	334.
006	---	477.	253.	353.
005	---	497.	417.	---
065	231.	236.	414.	181.
276	376.	102.	294.	---
501	378.	503.	519.	312.
278	594.	278.	561.	55.
505	---	1307.	745.	---
277	181.	552.	554.	71.
271	194.	272.	177.	---

Group 2A	Test			
(smokers)	1	2	3	4
298	174.	141.	174.	184.
307	122.	93.	275.	165.
291	174.	25.	447.	511.
287	61.	115.	95.	85.
248	165.	122.	301.	79.
299	174.	117.	340.	247.
303	227.	209.	194.	181.
401	337.	321.	596.	485.
309	249.	347.	485.	250.
305	223.	515.	713.	287.
288	260.	---	470.	718.
292	355.	167.	457.	367.
601	289.	177.	---	477.
261	295.	160.	204.	284.
250	34.	83.	243.	---
(non smokers)				
246	92.	138.	113.	118.
259	150.	103.	158.	---
304	204.	235.	200.	155.
249	135.	103.	226.	467.
257	141.	96.	121.	73.
400	150.	215.	217.	280.
251	91.	160.	97.	40.
255	100.	86.	108.	157.
290	204.	222.	230.	180.
301	355.	392.	220.	143.

URINE - Zinc

µg/liter of urine

(smokers)	1	2	3	4
112	296.	419.	465.	467.
111	65.	74.	382.	171.
180	29.	21.	99.	82.
142	127.	213.	755.	505.
221	172.	91.	168.	133.
187	277.	186.	---	---
236	29.	118.	---	---
149	62.	112.	79.	28.
176	11.	204.	104.	31.
600	297.	132.	152.	302.
139	101.	122.	248.	178.
230	175.	445.	101.	200.
204	198.	312.	276.	260.
210	153.	254.	203.	123.
098	35.	289.	159.	156.
122	237.	199.	184.	153.

(non smokers)

111	68.	77.	92.	82.
311	87.	152.	82.	73.
133	136.	240	155.	187.
203	110.	115.	118.	---
297	217.	---	125.	127.
080	184.	52.	76.	92.
161	92.	66.	---	66.
177	132.	---	124.	213.
110	132.	207.	184.	162.
224	235.	217.	124.	184.
129	143.	196.	108.	98.
296	117.	122.	127.	133.
222	87.	109.	162.	45.
094	234.	305.	184.	140.

(smokers)	1	2	3	4
091	42.	53.	14.	52.
131	168.	244.	---	---
227	402.	198.	215.	108.
245	653.	252.	211.	372.
226	63.	26.	45.	59.
126	225.	72.	47.	104.
229	222.	74.	85.	---
195	139.	421.	254.	286.
233	152.	110.	82.	100.
175	225.	244.	108.	50.
157	206.	153.	79.	83.
209	458.	---	448.	215.
188	276.	200.	133.	275.
123	232.	122.	170.	162.
182	355.	428.	---	291.
214	78.	102.	---	---
186	201.	118.	90.	98.
172	158.	334.	183.	---
244	220.	193.	186.	311.
109	360.	311.	189.	---
169	77.	49.	131.	---

(non smokers)

165	227.	149.	97.	138.
083	208.	334.	260.	---
136	104.	145.	19.	91.
215	208.	126.	120.	---
160	144.	169.	---	---
120	110.	99.	81.	104.
097	203.	149.	224.	---
213	219.	91.	216.	191.
225	235.	157.	308.	291.
134	207.	275.	119.	84.
166	81.	39.	---	---
125	301.	137.	228.	177.
170	---	216.	90.	93.
234	282.	137.	96.	213.
118	90.	107.	---	142.

Trace Elements in Feces

FECES - Cadmium

μg/g Feces

Group 1		Test		
(smokers)	1	2	3	4
022	0.20	0.12	0.18	0.22
054	0.25	0.19	0.20	0.17
038	--	0.16	0.27	0.30
029	0.30	0.19	0.14	0.27
030	--	0.13	0.20	0.20
020	0.15	0.18	0.21	0.18
033	0.20	0.19	0.26	0.19
016	0.20	0.17	0.21	0.18
069	--	0.18	0.16	0.18
036	0.15	0.13	0.27	0.17
040	0.10	0.16	0.07	0.14
008	0.15	0.13	0.23	0.18
039	0.15	0.15	0.21	0.38
027	0.15	0.19	0.24	0.30
032	0.15	0.19	0.17	0.11
042	0.10	0.19	0.14	0.13
023	0.10	0.12	0.19	0.14
026	0.20	0.22	0.20	0.33
053	0.11	0.19	0.24	0.37
012	0.06	0.06	0.20	0.05
047	0.13	0.12	0.31	0.36
014	0.14	0.19	0.20	0.13
017	0.14	0.19	0.28	0.24
071	0.21	0.13	0.27	0.15
(non smokers)				
046	0.15	0.17	0.13	0.22
035	0.28	0.33	0.13	0.21
024	0.25	0.18	0.21	0.28
013	0.35	0.30	0.19	0.18
019	0.20	0.16	0.11	0.25
015	0.15	0.20	0.10	0.20
049	0.10	0.23	0.14	0.26
055	0.15	0.12	0.12	0.08
034	0.25	0.41	0.15	0.26
045	0.10	0.05	0.19	0.08
067	0.20	0.25	0.22	0.26
070	0.04	0.08	0.15	0.15

Group 1A		Test		
(smokers)	1	2	3	4
350	0.11	0.15	0.15	0.15
348	0.13	0.36	0.14	0.18
329	0.13	--	--	0.15
336	0.21	0.21	0.24	0.02
321	0.11	0.03	--	0.01
313	0.14	0.15	0.12	0.04
284	0.16	0.20	0.15	0.14
320	0.26	0.32	--	0.44
340	0.09	--	--	0.14
318	0.30	0.45	0.50	0.19
339	0.16	0.19	0.14	0.13
283	--	0.14	--	0.09
337	0.24	0.17	0.68	0.12
346	0.37	0.24	--	--
352	0.11	0.09	--	--
314	0.21	0.20	0.14	0.18
315	0.13	0.15	0.14	0.09
349	0.17	0.18	0.14	0.26
286	0.27	0.21	0.10	0.10
325	0.20	0.32	0.13	0.18
345	0.36	0.30	0.73	0.28
316	0.57	0.24	--	0.08
331	0.40	0.28	0.19	0.12
(non smokers)				
323	0.28	0.09	0.17	0.11
312	0.28	0.43	0.21	0.26
285	0.14	0.15	0.09	0.07
326	0.23	0.21	0.11	0.10
258	0.16	0.12	--	0.20
343	0.10	0.19	0.12	0.12
327	0.19	0.31	0.11	0.17
330	0.18	0.24	0.16	0.15
351	0.23	0.22	--	0.17
338	--	0.17	0.15	0.32
324	0.20	0.26	0.18	0.18
328	0.34	0.28	0.16	0.25
341	0.17	0.28	--	0.22
319	0.16	0.13	--	0.10

FECES - Cadmium

μg/g Feces

Group 2	Test			
(smokers)	1	2	3	4
503	0.25	0.19	0.41	0.39
264	0.22	0.12	0.36	0.19
004	0.26	0.29	0.08	0.06
281	0.21	0.24	0.25	0.20
504	0.20	--	0.36	0.02
262	0.35	0.41	1.78	--
405	0.14	0.15	0.38	--
066	0.05	--	--	--
058	0.29	0.14	0.35	0.37
002	0.16	0.20	0.20	0.32
275	0.17	0.41	0.36	--
061	0.18	0.28	0.48	0.23
(non smokers)				
279	0.13	0.16	0.38	0.26
003	0.14	0.08	0.23	0.22
001	0.38	0.34	0.25	0.20
502	0.14	0.39	0.59	0.31
269	0.27	--	--	--
402	0.30	0.33	0.35	0.24
404	0.30	0.28	0.37	0.28
006	0.33	0.25	1.02	0.36
005	0.23	0.19	0.34	--
065	0.15	0.10	0.41	0.21
276	0.21	0.22	0.32	--
501	0.13	0.22	0.32	0.38
278	0.21	0.17	0.38	0.45
505	--	--	--	0.31
277	0.90	0.17	0.53	0.38

Group 2A	Test			
(smokers)	1	2	3	4
298	0.33	0.33	0.19	0.39
307	0.29	0.26	0.22	0.27
291	0.28	0.37	0.42	0.28
287	0.41	0.33	0.38	0.38
248	0.19	0.07	0.29	0.25
299	0.14	0.43	0.22	0.12
303	0.26	0.23	0.14	0.21
401	0.14	0.13	0.24	0.23
309	0.26	0.15	0.16	0.19
305	0.28	0.02	0.17	0.07
288	0.18	0.09	0.24	0.34
292	0.01	0.07	0.95	0.00
601	0.18	0.15	0.18	0.07
261	0.04	0.34	0.11	0.20
250	0.27	0.51	0.29	--
(non smokers)				
246	0.22	0.18	0.24	0.25
259	0.24	0.08	0.16	--
304	0.20	0.09	0.16	0.19
249	0.25	0.62	0.17	0.31
257	0.30	0.17	0.28	0.24
400	0.30	0.21	0.40	0.05
251	0.37	0.23	0.30	0.27
255	0.10	0.06	0.27	0.18
290	0.18	0.15	0.31	0.30
301	0.28	0.31	0.27	0.25

FECES - Cadmium

µg/g Feces

Group 3		Test			Group 3A		Test		
(smokers)	1	2	3	4	(smokers)	1	2	3	4
112	0.38	0.24	0.27	0.23	091	0.27	0.21	0.31	0.28
141	0.23	0.27	0.16	0.48	131	0.17	0.15	--	--
180	0.41	0.22	0.40	0.29	227	0.25	0.03	0.20	--
142	0.17	0.29	0.26	0.13	245	0.28	0.17	0.44	0.24
221	0.17	0.06	0.41	--	226	0.26	0.20	0.19	0.17
187	0.10	0.11	--	--	126	0.22	0.21	0.21	0.24
236	0.22	0.23	--	--	229	0.19	0.13	0.41	0.41
149	0.21	0.22	0.35	0.12	195	0.26	0.25	1.20	0.28
176	0.35	--	0.23	0.49	233	0.14	0.02	0.08	0.12
600	0.27	0.24	0.26	0.25	175	0.15	0.12	0.15	0.27
139	0.28	--	0.42	--	157	0.18	0.21	0.13	--
230	0.13	0.07	0.25	0.35	209	0.31	0.31	0.24	0.20
204	0.31	0.29	0.24	0.20	188	0.19	0.23	0.20	0.17
210	0.31	0.26	0.15	0.37	123	0.15	0.26	0.40	0.21
098	0.42	0.11	0.07	0.14	182	0.15	0.12	0.15	0.22
122	0.41	0.14	0.06	0.13	214	0.24	--	--	--
					186	0.14	0.10	0.16	0.20
					172	0.14	0.18	0.13	--
					244	0.10	--	0.21	--
					109	0.03	0.30	0.37	0.21
					169	0.34	0.35	0.30	--
(non smokers)					(non smokers)				
111	--	0.26	0.30	0.25	165	0.11	0.17	0.24	0.11
311	0.17	0.14	0.34	0.10	083	0.33	0.30	0.29	0.35
133	0.24	--	0.14	--	136	0.26	0.05	0.24	0.17
203	0.40	0.25	0.30	0.24	215	0.31	0.25	0.31	--
297	0.42	0.23	0.20	0.40	160	0.27	0.30	--	0.27
080	0.21	0.12	0.12	0.08	120	0.17	0.16	0.28	0.32
161	0.29	0.25	0.53	0.25	097	0.54	0.17	0.25	--
177	1.45	0.52	0.21	0.24	213	0.24	--	0.29	--
224	0.34	0.18	0.29	0.20	225	0.22	0.14	0.37	0.24
129	0.13	0.27	0.28	0.32	134	0.23	0.15	0.22	0.26
296	0.38	0.28	0.18	0.22	166	0.30	0.01	--	--
222	0.18	0.39	0.17	0.47	125	0.04	0.05	0.04	0.18
094	0.22	0.34	0.33	0.30	170	0.27	0.35	0.21	0.28
					234	0.24	0.26	0.23	0.27
					118	0.17	0.28	--	--

FECES - Lead

µg/g

Group 1 (smokers)	Test 1	2	3	4
022	1.1	22.1	1.3	1.1
054	2.2	2.1	2.2	16.7
038	8.6	2.0	3.0	1.3
029	1.4	3.2	5.1	1.0
030	---	7.5	2.3	2.5
020	2.5	1.7	2.2	2.2
033	0.5	2.8	4.3	1.2
016	2.2	1.5	2.8	1.5
069	---	3.1	1.0	4.9
036	1.3	4.9	2.5	1.4
040	1.0	2.6	0.6	1.2
008	1.3	4.4	1.5	2.2
039	2.2	2.8	2.9	2.8
027	1.2	0.8	0.6	2.0
032	1.2	2.9	1.1	1.3
042	1.2	2.4	0.7	1.0
023	1.1	1.7	1.3	1.3
026	19.4	3.4	1.8	3.2
053	2.8	3.0	2.8	3.1
012	1.2	0.9	2.8	0.9
047	2.0	2.2	2.3	2.3
014	4.3	1.9	2.2	0.9
017	6.2	4.7	2.5	1.6
071	2.1	0.6	2.2	1.4
(non smokers)				
046	0.6	2.1	1.2	1.2
035	0.9	1.6	2.4	1.4
024	0.7	4.1	3.2	0.9
013	1.0	---	2.6	2.4
019	0.7	0.2	1.9	1.4
015	1.8	1.6	1.0	4.6
049	1.0	1.4	0.7	0.8
055	2.9	2.1	0.9	1.5
034	1.9	5.5	2.0	4.8
045	1.0	1.1	1.6	0.7
067	5.2	2.6	2.1	3.5
070	0.3	1.1	1.2	1.9

Group 1A (smokers)	Test 1	2	3	4
350	0.7	1.3	1.3	0.5
348	0.3	1.5	0.7	2.1
329	0.8	---	---	2.2
336	2.3	1.2	2.9	7.8
321	0.4	0	---	0.2
313	2.5	1.0	3.5	1.3
284	0.9	0.9	2.0	0.7
320	4.3	1.8	---	2.2
340	0.8	---	---	0.4
318	4.9	6.3	2.8	1.8
339	4.2	13.1	2.5	3.7
283	---	1.6	---	0.6
337	4.1	1.6	---	1.3
346	2.5	1.4	---	---
314	26.0	1.5	2.4	4.6
315	2.7	2.0	4.1	2.0
349	0.7	1.4	1.6	2.5
286	1.3	3.8	5.8	0.5
325	0.9	2.0	1.8	3.7
345	2.6	1.6	1.7	2.5
316	0.6	0.8	---	0.6
331	1.5	3.2	2.8	2.0
(non smokers)				
323	1.6	0.7	1.6	1.3
312	1.8	2.9	3.1	3.4
285	0.7	0.6	0.5	1.2
326	4.8	2.0	4.7	3.5
258	1.3	0.1	---	2.5
343	1.2	3.3	0.6	2.2
327	1.0	1.6	0.7	2.2
330	2.3	2.3	1.9	1.1
351	4.8	2.4	---	4.0
338	---	0.9	---	1.2
324	1.2	2.2	2.5	1.3
328	1.0	2.5	4.1	1.3
341	1.2	0.9	---	0.9
319	0.9	0.4	---	1.9

FECES - Lead

µg/g

Group 2	Test			
(smokers)	1	2	3	4
503	2.0	1.3	7.5	7.3
264	3.5	1.7	2.8	2.4
004	2.4	1.7	1.5	0.7
281	1.1	1.3	1.2	2.2
504	0.7	---	0.1	0.6
262	0.7	3.0	2.0	---
405	4.6	3.5	2.1	---
066	0.6	---	---	---
058	6.7	2.4	6.8	1.7
002	0.9	0.6	0.9	2.0
275	2.2	1.5	1.8	---
061	2.3	4.4	3.3	3.3
(non smokers)				
279	1.1	2.5	5.2	2.1
003	0.8	0.6	1.5	2.0
001	1.6	2.3	0.9	3.0
502	1.7	2.3	1.0	5.5
269	6.6	---	---	---
402	1.9	1.2	0.7	2.0
404	1.9	2.3	3.7	5.8
006	4.2	1.5	0	3.6
005	2.6	1.5	2.1	---
065	3.4	2.3	1.9	6.4
276	1.3	1.8	3.4	---
501	0.7	0.6	1.4	3.0
278	4.3	0.8	1.2	2.0
505	---	---	---	2.8
277	0.2	0.8	2.5	2.7

Group 2A	Test			
(smokers)	1	2	3	4
298	5.5	3.8	6.1	1.4
307	3.1	11.8	2.2	---
291	12.6	12.3	2.4	3.0
287	2.6	2.8	4.0	1.9
248	1.5	0.8	0.2	0.3
299	4.7	4.5	3.9	1.5
303	1.9	3.0	1.2	1.3
401	1.3	0.6	1.8	1.8
309	1.5	0.8	1.5	1.7
305	3.4	0.9	0.9	0.9
288	1.5	0.3	0.3	0.7
292	0.0	0.6	0.1	0.2
601	1.8	0.6	1.7	1.7
261	0.4	0.4	0.3	1.0
250	2.3	5.5	0.4	---
(non smokers)				
246	3.5	0.2	3.6	1.0
259	1.0	0.9	2.6	---
304	1.1	2.6	0.9	2.4
249	5.2	1.9	0.7	2.0
257	2.2	1.6	0.6	2.4
400	1.2	1.1	1.1	0.5
251	2.4	5.0	0.6	2.1
255	3.2	0.4	1.5	1.8
290	1.0	1.0	1.7	1.8
301	11.3	2.2	1.0	1.4

FECES - Lead

µg/g

Group 3	Test			
(smokers)	1	2	3	4
112	2.9	2.1	1.3	0.8
141	4.7	4.3	2.4	1.3
180	4.0	2.8	1.9	7.5
142	1.0	2.5	1.4	0.8
221	2.0	1.4	2.3	---
187	2.1	2.0	---	---
236	0.9	2.0	---	---
149	3.2	3.2	1.8	1.4
176	7.0	---	2.6	2.6
600	3.0	2.1	2.1	1.6
139	3.3	---	4.3	---
230	2.4	0.5	1.8	4.0
204	2.0	0.7	1.5	0.9
210	2.4	3.1	2.5	2.4
098	0.7	1.8	2.1	1.5
122	0.7	2.6	2.3	2.5
(non smokers)				
111	---	2.1	1.1	1.4
311	1.8	1.0	2.9	0.3
133	7.3	---	2.4	---
203	3.9	3.4	8.5	3.4
297	5.7	3.8	3.0	2.3
080	1.5	2.8	1.1	4.6
161	16.1	6.0	2.5	3.4
177	6.4	9.7	1.5	5.5
224	3.7	1.5	4.3	1.9
129	3.0	2.5	3.2	2.5
296	2.6	2.9	2.2	4.9
222	1.4	1.5	1.4	5.4
094	2.5	2.5	2.1	6.4

Group 3A	Test			
(smokers)	1	2	3	4
091	3.6	15.9	3.9	2.1
131	0.6	0.6	---	---
227	0.5	1.3	1.2	---
245	0.1	1.2	3.2	0.7
226	3.2	1.4	1.6	1.6
126	11.7	4.8	2.4	1.1
229	1.4	3.3	1.5	2.6
195	1.1	0.5	2.5	1.5
233	1.4	1.4	0.9	0.2
175	1.1	1.4	2.4	1.1
157	0.1	1.1	2.4	0.1
209	2.2	1.4	2.9	1.8
188	0.6	2.0	1.8	30.4
123	0.6	1.7	0.7	2.0
182	0.6	0.6	2.0	1.9
214	3.1	---	---	---
186	2.4	0.1	0.0	0.9
172	1.1	0.6	0.5	---
244	2.0	---	0.7	---
109	12.0	1.8	6.8	4.0
169	3.6	7.6	4.2	---
(non smokers)				
165	0.8	0.2	1.1	1.6
083	1.4	3.5	2.2	6.1
136	4.2	2.0	3.4	2.6
215	0.8	2.5	0.5	---
160	3.6	4.1	---	1.8
120	0.2	0.7	14.7	3.1
097	4.6	1.0	2.2	---
213	2.1	---	3.5	---
225	1.5	1.4	1.3	20.3
134	6.7	1.2	3.3	6.2
166	2.0	0.5	---	---
125	0.3	0.3	0.0	0.2
170	2.4	1.3	2.3	4.8
234	3.2	1.1	2.3	3.3
118	2.5	0.4	---	---

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2002 22     11518   23134511 2  1  3            2 \0002
2003 22     22      13131912 2  2  3            2 \0003
2004 22     11116   32 32412 2  2  3            2 \0004
2005 22     22      26132512 2  2  3            2 \0005
2006 22     22      13132214 2  1  3            2 \0006
2008 11 1 1411421   25133711 2  1  7            1 \0007
2012 12     11219   43134511 2  1  7            1 \0008
2013 11 1 1222      25133111 2  1  7            1 \0009
2014 11 1 1211316   23 32711 2  1  7            1 \0010
2015 11 1 1222      25133311 2  1  7            1 \0011
2016 11 1 1411320   25133511 2  1  7            1 \0012
2017 12     122161825132312 2  1  7            1 \0013
2019 12     22      25133411 2  1  7            1 \0014
2020 12     11423   24 83011 2  1  7            1 \0015
2022 11     11419   25134311 2  1  7            1 \0016
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2046 12     22      26 22914 2  1  7            1 \0033
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2049 12     22      25 52511 2  1  7            1 \0035
2053 12     11 18   25132012 2  1  7            1 \0036
2054 12     11316   25132511 2  1  7            1 \0037
2055 12     22      25 32111 2  1  7            1 \0038
2058 22      1319   23133912 2  2  5            2 \0039
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2065 22     21119   23 82511 2  2  5            2 \0041
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2118 62     22      23113021 2 22  0            3A\0057
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2122 52     11319   15 62424 2 11  0            3 \0059
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2125 62     22      26132723 2 21  0            3A\0061
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2160 62      22        27132922 2 22   0                     3A\0073
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2175 62      122182527 42621 2 21   0                     3A\0080
2176 62      11118     14 91924 2 11   0                     3 \0081
2177 62      22        16 22321 2 11   0                     3 \0082
2180 52      121181916 42321 2 11   0                     3 \0083
2182 51     1114       43 72421 2 21   0                     3A\0084
2186 62      11318     15132821 1 21   0                     3A\0085
2187 52      12 183233133522 2 12   0                     3 \0086
2188 52      11125     45 42521 2 21   0                     3A\0087
2195 52      11223     24 32321 2 21   0                     3A\0088
2203 52      22        14 22021 2 11   9                     3 \0089
2204 52      11120     15 62521 2 11   9                     3 \0090
2206 52      11116     26 22021 2 21                           \0091
2209 52      11216     25 32621 2 21   9                     3A\0092
2210 52      123182026 12324 2 11   9                     3 \0093
2213 62      22        26 12121 2 21   9                     3A\0094
2214 62      11218     26 22221 2 21   9                     3A\0095
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2221 52      11418     24132421   11   9                     3 \0097
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2225 62      22        26 22221 2 23   9                     3A\0100
2226 62      11317     26122721 2 21   9                     3A\0101
2227 62      11314     16 62421 2 21   9                     3A\0102
2229 62      123182127132321 2 21   9                     3A\0103
2230 52      11316     45 93121 2 11   9                     3 \0104
2233 62      121192226 22321 2 21   9                     3A\0105
2234 62      22        25 22421 2 21   9                     3A\0106
2236 62      11320     27 12324 2 11   9                     3 \0107
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2245 62      11219     26 62621 2 21   9                     3A\0109
2246 92      22        23 12411 2 21   9                     2A\0110
2248 42      11420     25122914 2 21   9                     2A\0111
2249 42      22        26132414 2 21   9                     2A\0112
2250 42      11212     13 42511 2 21   9                     2A\0113
2251 42      22        16 12311 2 11   9                     2A\0114
2253 92      11518     25103211 2 21   9                     1A\0115
2255 42      21216     12133711 2 21   9                     2A\0116
2257 42      22        26 23111 2 11   9                     2A\0117
2258 92      22        25 62411 2 21   9                     1A\0118
2259 41     222        15 12411 2 11   9                     2A\0119
2261 42      11219     15 12214 2 11   9                     2A\0120
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2264722      11 17     22133212 2  2   1                     2 \0122
2266722      11417     12 11812 2  2   1                     2 \0123
2269722      224161922 22012 2  2   1                     2 \0124
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